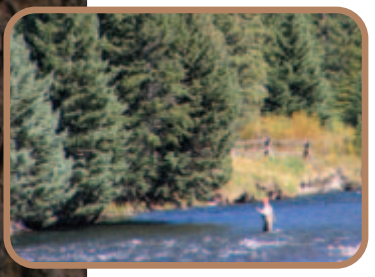
Final Environmental Impact Statement Amending and Adopting the Draft Environmental Impact Statement for the Gallatin River Outstanding Resource Water Designation



Montana Department of Environmental Quality

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January 9, 2007

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January 9, 2007

J5060-2

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January 2007

Dear Reader:

Enclosed is the Final Environmental Impact Statement (EIS) for the Gallatin River Outstanding Resource Water Designation adopting the draft EIS as a part of the final, responding to public comments, and providing substantive changes that amend the draft EIS in response to public comments. The final EIS contains responses to public comments on the draft EIS and adopts the draft EIS as part of the final with modifications in response to public comments. Thus, the draft EIS, as amended by this final EIS, is adopted as part of the complete final EIS.

In December 2001, the Montana Board of Environmental Review (BER) received a petition to designate the Gallatin River as an outstanding resource water (ORW) from the Yellowstone National Park boundary to Spanish Creek. At its March 2002 meeting, the BER ordered the Montana Department of Environmental Quality (DEQ) to prepare an EIS to disclose the potential impacts of ORW designation.

The draft EIS was published on September 8, 2006. Public comments were accepted until October 27, 2006. A public hearing on the draft EIS and the draft rules was held in Gallatin Gateway on October 25, 2006.

Under the Proposed Action, the BER would adopt a rule for the Administrative Rules of Montana designating the river an ORW. The legislature would have to approve legislation to implement the rule.

The final decision will be made in the Record of Decision that will be published no sooner than 15 days after the release of this final EIS.

DEQ and the BER appreciate the public's involvement in preparing the final EIS. The draft and final EISs are available on DEQ's web site at www.deq.mt.gov. Additional copies are also available upon request from DEQ. A copy of the Record of Decision will be sent to everyone who receives the final EIS.

Richard H. Opper
Director

Executive Summary

Introduction

This Final Environmental Impact Statement (FEIS) adopts the Draft Environmental Impact Statement for the Gallatin River Outstanding Resource Water Designation, published in September 2006, as final with amendments made in response to public comments. This EIS has been prepared to assess the impacts of designating a reach of the Gallatin River as an Outstanding Resource Water (ORW). In 1995 Montana passed legislation allowing such designation, and in 2001 the Montana Board of Environmental Review (Board) was petitioned to consider designating the reach of the Gallatin River from the Yellowstone National Park boundary downstream to the river's confluence with Spanish Creek (Figure 1), as Montana's first ORW outside of a national park or wilderness. The geographic scope of this EIS includes the ORW reach and lands around the ORW which have a hydrologic connection to this reach. The ORW designation would protect water quality in the reach by prohibiting certain actions that would decrease its current level of quality. Upon review of this EIS, the Board may adopt a rule to classify the specified reach of the Gallatin River as an ORW; however, the designation as an ORW will not become effective until the Montana State Legislature votes to approve it.

Purpose and Benefits of the Proposed Action

The purpose and benefit of the proposed action is to protect existing water quality in the ORW reach of the Gallatin River. Under ORW status the DEQ could not grant an authorization to degrade water quality, nor could it allow a new or increased point source discharge that resulted in a permanent change in the water quality of the ORW reach. The petitioner believes that this level of protection is necessary due to the current high water quality, and due to potential sources of degradation. Six of the nine major tributaries in the upper Gallatin River drainage are currently listed as having impaired water quality. Further, the Montana Water Quality Act allows users to apply for discharges that may result in degradation of existing water quality. Finally, county zoning and DEQ regulations (including point source nondegradation reviews) allow for incremental reductions in water quality. Thus, the petitioner held that ORW status is the only regulation that would allow for protection of the ORW reach by preserving the current high quality of water in the proposed ORW reach. The Board will review this EIS and determine whether it agrees with the petitioner on this count.

Alternatives Description

Several alternatives were considered in this EIS, and some were eliminated from further consideration. The alternatives fully evaluated in the EIS were the No Action Alternative, the Proposed Action Alternative (ORW designation,) and the Cumulative Impacts Analysis Alternative, under which DEQ would exercise existing authority to evaluate cumulative impacts to water quality.

No Action Alternative

Under the No Action Alternative, the Board would not adopt a rule and ORW designation would not proceed. Current water quality laws would remain in force and there would be no changes to DEQ's water quality management in the proposed ORW reach. DEQ could issue authorizations

to degrade, and permits for new and increased point source discharge. Narrative nondegradation limits could be used in lieu of numeric nondegradation limits. Water quality could be allowed to degrade to current state standards, but could not exceed those standards.

Proposed Action Alternative: Outstanding Resource Water Designation

Under the Proposed Action Alternative, the Gallatin River would be designated an ORW from the Yellowstone National Park boundary to the river's confluence with Spanish Creek. Under this designation DEQ could not allow any activity that caused any permanent and measurable change to water quality within this reach. DEQ could not issue any authorizations to degrade.

To assess land use and socioeconomic impacts from the Proposed Action Alternative, DEQ developed a footprint, a map of land areas that have a direct hydrologic connection to the surface waters of the proposed ORW reach. Any planned developments that would discharge wastewater to ground or surface water within the area of hydrologic connectivity would have to pass water quality reviews showing that their impacts, when reviewed cumulatively with other discharges, would be below numeric trigger values for water quality standards. No narrative water quality standard would be used. The two trigger values most relevant to development and water quality in the proposed ORW reach are measures of phosphorus and nitrogen, specifically inorganic phosphorus and nitrate (as N). If conventional methods of wastewater treatment for a development did not meet ORW limits, then alternative methods of wastewater treatment and disposal would need to be used for development to proceed.

Cumulative Impacts Analysis Alternative

Under the Cumulative Impacts Analysis Alternative, DEQ would exercise its discretion to evaluate the impact of developments to surface water quality when added to those of other past and pending permits. Although DEQ has the authority to perform this kind of nondegradation review, its current policy is to evaluate each development independently. Similar to the Proposed Action Alternative, this alternative was evaluated using the footprint, which indicates which lands have a direct hydrologic connection to the surface waters of the Gallatin River. However, under this alternative, if a development did not meet the nondegradation standards, the owner could apply for an authorization to degrade, and could request use of a narrative water quality standard, two options which are not available under the Proposed Action Alternative. DEQ could rescind its use of the cumulative impacts analysis at any time, without public review or comment. Under the Cumulative Impacts Analysis Alternative each development that contributed to the allowable nutrient load to the Gallatin River would reduce the remaining load. Therefore, later developments may have to meet stricter wastewater discharge concentration criteria.

Alternatives Considered and Eliminated

Several alternatives were initially considered, but not fully analyzed as they were not reasonable or feasible, or do not meet the purpose and benefit of the Proposed Action. Designating the Gallatin River as a Wild and Scenic River was considered; however, this federal designation only protects water quantity, and does not protect water quality. Consideration was also given to developing trigger values for water quality for five sub-watersheds within the Gallatin ORW. However, development of such water quality sub-watershed values would require difficult mathematical modeling and would create regulatory confusion among agencies. Another

alternative considered and dismissed would be to divide up the pollutant load into values applicable to each single family equivalent, and then limit housing and commercial development. However, this alternative was dismissed as impractical since DEQ does not have the authority to implement zoning or regulate development.

Affected Environment

The affected environment section provides a baseline of information from which to analyze and compare the effects of the various alternatives. The dominant hydrologic feature in the Upper Gallatin Valley is the Gallatin River and its tributaries. The mainstem Gallatin River is generally broad, meandering and low gradient, while the tributaries are steeper, straighter and narrower. Nine major tributaries flow into the proposed ORW reach, including Spanish Creek which delineates the downstream end of the proposed ORW reach. US Highway 191 encroaches on the Gallatin River in several places in the proposed ORW reach, and crosses it three times.

Historic development in and around Big Sky has affected water quality via increased nutrients (nitrates and inorganic phosphorus) through wastewater discharges, construction activities, and other sources. Algal growth in the river indicates input of nutrients from the West Fork into the mainstem Gallatin River. Six tributaries to the proposed ORW reach have had recent TMDL assessments, and are listed as impaired for some of their beneficial uses. The West Fork of the Gallatin River was downgraded in the 2006 assessment to "non-support" for both the cold water fishery and contact recreation designated uses. Water quality in the mainstem is generally very good with some nitrate enrichment.

Most of the land along the river is in public ownership, largely under federal management by the Gallatin National Forest. Private land ownership is concentrated near Big Sky, with some private ownership along the Gallatin River and US Highway 191. The primary recreational uses of the proposed ORW reach are fishing, and commercial and recreational rafting and kayaking. The Gallatin River is known as a 'blue-ribbon' trout fishery. Rainbow trout dominate, while brown trout are more limited; other fish common in the river are mountain whitefish, two species of sucker, and a sculpin. There are no known cultural sites that overlap the proposed ORW reach, although the surrounding area has several documented cultural sites.

Over half the housing in and around Big Sky is leisure-oriented or seasonally occupied. One out of three people in Big Sky and West Yellowstone are directly employed in tourism. The current net economic value of the recreational fishery and commercial rafting in the proposed ORW reach are estimated at $3.8 and $4.6 million per year, respectively.

The vegetation along the Gallatin River is dominated by coniferous forest, grasslands, shrubland, and riparian vegetation. A number of big game species frequent the area including moose, elk, mule deer, whitetail deer, and bighorn sheep. The riparian vegetation is used by songbirds, including neotropical migrants, and by raptors and waterfowl.

Comparison of Alternatives and Impacts

This EIS evaluates the Proposed Action (ORW designation), the No Action, and the Cumulative Impacts Analysis alternatives. This EIS differs from others in that it evaluates a regulatory action; thus the Proposed Action Alternative analyzes the impacts of maintaining the existing water quality conditions in the Gallatin River. The No Action Alternative analyzes the impacts of maintaining the existing regulatory environment. The Cumulative Impacts Analysis Alternative analyzes the impacts of DEQ exercising its discretion to review cumulative impacts of multiple developments on the ORW reach. Table 1 displays an annotated comparison of impacts across all alternatives and all resource areas.

No Action Alternative

Under the No Action Alternative, residential and commercial development could proceed along the proposed ORW reach, with water quality regulated under existing law and rules. The current nondegradation rules of DEQ would apply (both numeric and narrative limits) and water quality in the ORW reach would be allowed to deteriorate in incremental amounts.

Land use analysis shows there are approximately 652 developable units left within the footprint area of the ORW. For purposes of water quality permitting, the Gallatin River mainstem could be considered a mixing zone, and loading of nitrate and inorganic phosphorus in soils due to septic systems would increase. However, analysis shows that exceedance of the inorganic phosphorus trigger value in the Gallatin River mainstem would occur well before full build-out in the footprint. Given this information, it is likely that some restrictions on wastewater treatment may be enacted before full build-out is completed in order to comply with the water quality regulations for high quality waters. In addition, nutrient enrichment would likely contribute to more algal growth. Algal growth and nutrient level increases could contribute to changes in the macroinvertebrate communities, decreases in recreational value, and lower angler catch or satisfaction. Further, changes in the macroinvertebrate community could lead to slower fish growth and a decreased quality of angling experience in the Gallatin River.

Proposed Action Alternative: Outstanding Resource Water Designation

Under the Proposed Action Alternative, DEQ could not permit actions that would permanently degrade water quality. This regulation would limit the development that could occur within the footprint that used traditional wastewater treatment systems (septic systems and drainfields). However, with mitigation, such as the use of alternative wastewater treatment systems, including advanced subsurface treatment (recirculating sand filters, chemical removal, and composting or incinerator toilets), zero discharge options (off-site disposal), or centralized treatment options, development within the area of hydrologic connection could proceed to over 50% of full build-out. Even using combinations of advanced treatment options, there will probably be a loss of approximately 291 of the developable units left with the footprint; these units will not be able to be developed, given current technologies, economic constraints, and regulations. However, if regulations were revised and on-site non-discharging options, such as holding tanks, were allowed, then all 652 units could be developed within the footprint. For units that are developed,

these alternative wastewater treatment systems would add, on average, roughly 2% to the cost of a lot and home in the area surrounding the proposed ORW reach.

Nutrient loading in the soils would be limited within the developable lands in the footprint. Without mitigation, approximately 67 residences (Single Family Equivalents) could be built within the footprint before the inorganic phosphorus trigger value in the Gallatin River was reached.

Cumulative Impacts Analysis Alternative

The impacts of the Cumulative Impacts Analysis Alternative would be similar to those under the Proposed Action Alternative. Limited loading of nutrients to soils in the footprint would be allowed. Each successive development would have to show that its input to the river would not exceed trigger values when combined with inputs from existing and concurrent developments. As the area became more developed and the nutrient level in the river approached trigger values, passing cumulative impact nondegradation analysis would become more and more difficult using a conventional wastewater treatment system. In essence, this alternative would create a 'first come, first served' situation where development shortly after implementation would undergo little or no additional restrictions, but eventually the inorganic phosphorus load in the river would approach the trigger values. Thereafter, developments would be restricted or would need to discharge outside of the footprint area. This alternative might thus create a rush of development as developers try to get projects approved before the trigger values for nutrients in the ORW are approached. The trigger values are the same under all alternatives; therefore, under this alternative as under the Proposed Action Alternative, approximately 67 SFEs could be built in the footprint before trigger values would be reached.

Secondary and cumulative impacts to water quality, aquatic resources, fisheries and recreation are similar under this alternative to those under the Proposed Action Alternative. This alternative differs from the Proposed Action Alternative in that its protection of water quality in the mainstem Gallatin River is less certain, due to the administrative rather than legislative nature of the protection.

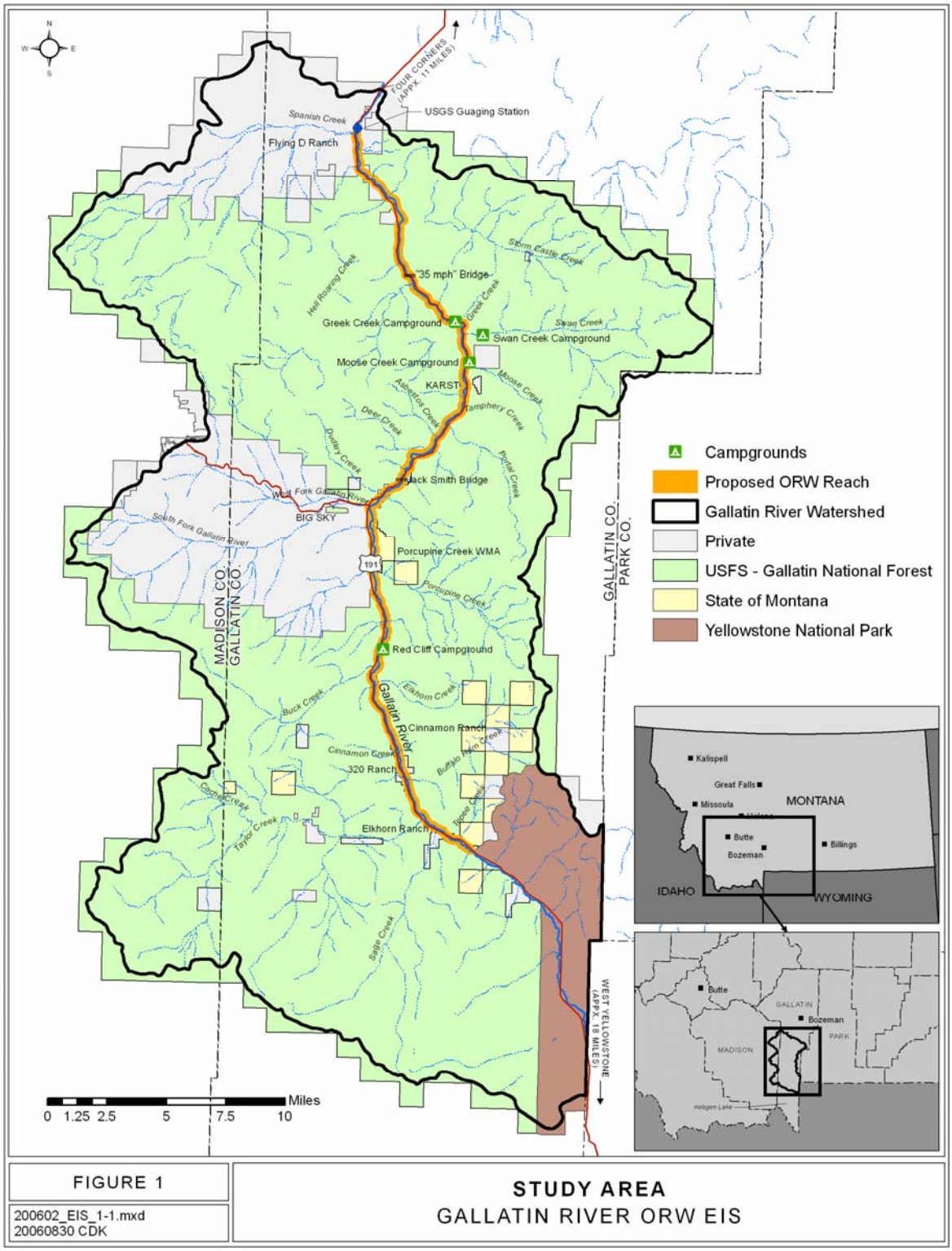

Figure E-1. Study area for the proposed Outstanding Resource Water reach of the Gallatin River in Gallatin and Madison counties, Montana.

Table E-1. Condensed description of potential impacts related to the three alternatives considered in detail in the Gallatin River Outstanding Resource Water Designation Environmental Impact Statement.

Potential Impact **(PI) = Primary** **(SI) = Secondary** **(CI) = Cumulative**	**Common to All Action Alternatives**	**Alternative 1: No Action**	**Alternative 1: No Action with Mitigation Measures**	**Alternative 2: Proposed Action**	**Alternative 2: Proposed Action with Mitigation Measures**	**Alternative 3: Cumulative Impacts Analysis**	**Alternative 3: Cumulative Impacts Analysis with Mitigation Measures**
Hydrology and Water Quality							
Water quality - general	**(PI)**: Water quality standards remain same.	**(PI):** Nondegradation standards for inorganic phosphorus and nitrate (as N) remain numeric and narrative. Water quality regulated under the existing rules of DEQ and counties. Local governments required comply with nondegradation requirements that are not part of State's review. Additional nutrient loading to Gallatin River from future build-out. Probable measurable change in water quality.		**(SI):** Change from recently documented trend degrading water quality to stabilized level. Limit amount phosphorus & nitrogen entering the river; prevent permanent, measurable degradation water quality. **(SI):** Stabilization of, or even improvement aquatic habitat.		**(SI):** Similar to those described under Proposed Action.	
Water quality – regulated sources		**(SI):** Increased nutrient loading in Gallatin. **(CI):** Cumulative impacts from regulated sources which contribute nutrients. Increases in sediment loading due to projected levels development on undeveloped and partially developed private land. Expansion residential development in Big Sky likely increase service connections to Big Sky County Water and Sewer District. This increase could lead to more nutrient loading in Gallatin River if District uses its MPDES flow-based discharge permit. Cumulative impacts regulated and nonregulated development lead to measurable increases in pollutant levels in Gallatin River.		**(SI):** Due to restriction nutrient loading from subsurface wastewater treatment systems, septic system drainfields outside footprint when development lies within footprint. This placement may concentrate drainfields adjacent to footprint boundary, potentially impacting other groundwater sources due spatial limits on drainfield locations. New development may be forced outside footprint. **(CI):** Cumulative impacts to water quality of Gallatin River would less than from No Action Alternative, since pollution from regulated sources of nutrients capped by "no measurable change" criteria.		**(SI):** Developers may seek approval sooner than later for drainfields within footprint to take advantage of waste load allocation. May encourage faster development within footprint until cumulative impacts analysis indicates trigger value met, then placement may concentrate drainfields adjacent to footprint boundary, potentially impacting other groundwater sources.	
Water quality – nonregulated sources	**(CI):** Sources wastewater discharge, not regulated by the federal, state or local agencies, not addressed. Cumulative degradation from these sources & permissible nonpoint sources may degrade water quality.	**(SI):** Unregulated development may lead measurable nutrient increases receiving streams; including landscape fertilizer runoff, livestock associated with recreation industry, release soil nutrients from timber clearing, increased storm water runoff, or general soil disturbance.					

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Cumulative Impacts		**(CI):** Cumulative impacts from multiple independently proposed developments not evaluated in regulatory framework.		**(SI):** Accounts for cumulative impacts subsurface wastewater treatment by limiting total nutrient loading under low flow conditions to below measurable change, i.e. trigger value for inorganic phosphorus.		**(SI):** Similar to Proposed Action.	
Mixing zones		**(SI):** If nondegradation limits nutrients not met in ground water prior to effluent reaching Gallatin River, mixing zone in river can be adopted. Result in localized reaches with elevated nutrient levels which may exceed trigger values until attenuation reduces levels below measurable change. Could allow permitting subsurface wastewater treatment systems which rely on mixing zone in Gallatin River for compliance.					
Water withdrawals	**(CI):** Water withdrawals expected increase with more individual wells drilled. Impact directly related to number SFEs using individual or community wells. (See Impacts described under Land Use and Socioeconomics for these numbers)						
Nutrient input		**(SI):** Increased transport nutrients to receiving waters (Gallatin River or tributaries). Increase nutrients could enhance algal and periphyton growth.		**(SI):** Decreased transport nutrients to receiving waters (Gallatin River or tributaries). Maintenance nutrient levels in ORW reach would limit proliferation periphyton and nuisance algae. **(CI):** Increase service connections to Big Sky County Water and Sewer District could cause more nutrient loading in Gallatin River if District uses its MPDES flow-based discharge permit.	**(SI):** Nutrient input could not increase with mitigation. Impacts same as under Proposed Action	**(SI):** Intermediate between those described under Proposed Action and No Action. Cumulative assessment should reduce overall nutrient input compared to No Action.	**(SI): N**utrient input could not increase with mitigation. Impacts same as under unmitigated Cumulative Impacts Analysis Alternative.

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Wastewater discharge and management		**(SI):** Increased nutrient loading soils result in nutrient saturation, primarily inorganic phosphorus. Increased mass soil containing or holding contaminants within footprint.		**(SI):** Reduced nutrient loading soils from subsurface wastewater treatment in footprint. Less nutrient loading soils due to limit of receiving stream (Gallatin River or tributaries) required have no measurable change water quality.	**(SI):** To meet ORW regulations nutrient input could not increase with mitigation. Therefore Impacts in this area would be the same as under the Proposed Action Alternative	**(SI):** Similar those under Proposed Action.	**(SI):** Nutrient input could not increase with mitigation. Impacts same as under unmitigated Cumulative Impacts Analysis Alternative.
Geology and Soils							
Ground disturbance	**(PI):** Disturbance would occur.	**(SI):** Increased erosion of disturbed soils could degrade water quality. **(CI):** Development footprint continues to full build-out.	**(CI):** Development and ground disturbance could occur same or greater density as unmitigated alternative.	**(CI):** Limits development could potentially limit total ground disturbance.	**(CI):** Development and ground disturbance could occur, but would be less than with unmitigated alternative.	**(CI):** Total acres disturbed for developed units probably between no-action and proposed action alternative.	**(CI):** Development and ground disturbance could occur with similar density as unmitigated alternative.
Erosion/sediment transport	**(CI):** Increased sediment loading due to projected levels development on undeveloped and partially developed private land.			**(CI):** Increased sediment loading lower, due to projected lower levels development on undeveloped and partially developed private land.	**CI):** Increased sediment loading lower than No Alternative, but higher than Proposed Alternative without mitigation		
Developable terrain	**(SI):** Development in footprint would continue.	**(SI):** Greater likelihood disturbance wetlands & riparian habitat. **(CI):** Development footprint continues on suitable terrain. Development steep terrain likely.	**(CI):** Development in footprint same or greater density, within limits of zoning regulations, if alternative wastewater management facilities employed.	**(SI):** To prevent receiving streams from experiencing measurable water quality change, sources nutrient loads to groundwater hydrologically connected to streams within footprint limited. Within/near footprint some development could shift to less amenable terrain; steeper slopes or less stable soils. Could cause soil disturbance steeper areas with higher erosion potential.	**(CI):** Development in footprint with density still less than under No Action.	**(CI):** Total numbers developed units probably between No Action and proposed action. Difficult to assess spatial arrangement on developable terrain.	**(CI):** Development in footprint with density similar to No Action may occur if alternative wastewater management facilities employed.
Wastewater management		**(PI):** Less stringent management. **(SI):** Increased nutrient loading to soils result in nutrient saturation, primarily inorganic phosphorus. Increased mass soil containing/holding contaminants within footprint. Increased transport nutrients to receiving waters.		**(SI):** Reduced nutrient loading to soils from subsurface wastewater treatment in footprint. Less nutrient loading soils due to limit of receiving waters required to have no measurable change water quality. Decreased transport nutrients to receiving waters.	**(SI):** Nutrient input could not increase with mitigation. Impacts same as under Proposed Action.	**(SI):** Similar to Proposed Action.	**(SI):** To meet cumulative assessment regulations, nutrient input could not increase with mitigation. Impacts same as under unmitigated Cumulative Impacts Analysis Alternative.

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Land Use and Recreation							
Land use - general		**(SI):** No impact on existing or planned land use within footprint or beyond ORW study area. Development would proceed according to plans/regulations agencies having land use jurisdiction within footprint.	**(SI):** Same as No Action without mitigation.	**(SI):** Restrict new development using conventional septic tank/leach fields in footprint. Development restrictions on private land applied to all undeveloped or partially developed land in footprint.	**(SI):** Development restrictions not entirely mitigated by use alternative wastewater management systems. Use of such systems involves increased development cost. About one-third of SFE development curtailed.	**(SI):** New development in footprint using conventional septic tank/leach field would likely be restricted, but to lesser extent than allowed by Proposed Action without mitigation, due to continued availability narrative standard & authorization to degrade options within existing regulations. Development restrictions (or potential) on private land not equally applied. Permitting of new development on a first come, first served basis. Applicants acting first, before cumulative pollutant trigger values reached able to develop using conventional septic tank/leach fields. Once cumulative trigger values reached, further applicants face increased costs or restrictions on allowable development.	**(SI):** Development restrictions similar to Cumulative Impacts Analysis Alternative without mitigation. First come, first served approach inherent; mitigation likely used by later applicants.
Allowable development		**(SI):** Private Land: Current Gallatin County plans/ zoning regulations allow up to 652 additional dwelling units and estimated 419,000 sq. ft. additional commercial & community facilities built on currently undeveloped or partially developed lands in footprint. Forest Service Land: No plans for new facilities or expansions existing facilities in t footprint. State Land: Montana Fish, Wildlife and Parks may seek expansion Porcupine Creek complex near Big Sky; however no current plans to expand.	**(SI):** Same as No Action without Mitigation	**(SI):** A total of 75 additional dwelling units (DU) and approximately 2,645 sq. ft. additional commercial & community facilities allowed in footprint using conventional septic tank leach field wastewater management systems. This impact represents an 89% reduction in allowable additional dwelling units and an overall 99% reduction in allowable additional commercial or community facilities square footage.	**(SI):** Assuming use of alternative wastewater management, probably reduction in one-third of developable SFEs compared to No Action.	**(SI):** Not possible to quantify allowable development under this alternative due to narrative standard and authorization to degrade variables. Additional development in footprint would likely higher than estimates for Proposed Action without mitigation, due to availability these options. However, given State regulations & policy related to nondegradation, and the same degradation trigger values as under Proposed Action, unlikely that development approaching that expected under No Action would be permitted.	**(SI):** Assuming use of alternative wastewater management, potential additional development in footprint similar to No Action.

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Recreation	**(PI):** No primary impacts on recreation.	**(SI):** No adverse primary impacts on recreation: Neither levels nor extent of development anticipated in footprint would impose new constraints on river access or capacity of river to accommodate recreation. **(SI):** Secondary water quality impacts due to increased development in footprint can have corresponding secondary impacts on recreation: Adverse fishery impacts (reduced fish size or carrying capacity in ORW reach) would adversely impact angler use and satisfaction; and adverse aesthetic impacts (as algal blooms) could reduce attractiveness of ORW reach. **(C1):** Water quality impacts from development in footprint could act cumulatively with similar impacts from development outside footprint (e.g., the larger Big Sky area), resulting corresponding cumulative secondary impacts to recreation.	**(SI, CI)**: Avoidance of or reduction in secondary or cumulative recreation impacts dependent on mitigation measures applied for secondary water quality impacts. If water quality mitigation successful, corresponding recreation impacts reduced.	**(SI):** Reduction in pollutant loads in river, compared with No Action; long-term positive effect on recreation by protecting river attributes important to recreation users. Quality of recreational experience, as influenced by water quality, protected.	**(SI):** Same as Proposed Action without mitigation.	**(SI):** Similar to Proposed Action without mitigation.	**(SI):** Similar to Proposed Action without mitigation.
Rafting/boating	**(SI):** Commercial rafting days & private shoreline & river-boating use days expected to continue & may increase slightly. **(CI):** Might be slight increase commercial rafting & recreational tourism.			**(SI):** Probably same as No Action.		**(SI):** Probably same as No Action.	
Angler use		**(SI):** If trout population declines, recreational fishery could see decreased angler use. Potentially fewer anglers make ORW destination for fishing trips. Impacts to popular caddis, mayfly & stonefly hatches could affect recreational fishery. Anglers may fish alternative rivers (Yellowstone & Madison) if seasonal hatches on Gallatin		**(SI):** Anglers continue come to Gallatin to fish “blue ribbon” fishery. Angler use may increase in short term if publicity of ORW designation entices them to the river.		**(SI):** Angler satisfaction likely remains high.	

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		noticeably reduced. Relocation angler activity would reduce associated tourism dollars.					
Angler satisfaction		**(SI):** Adverse impacts to the fishery (i.e. reduced trout growth and carrying capacity, therefore reduced size and numbers of fish) would reduce angler satisfaction.		**(SI):** Angler satisfaction likely remains high or increase with cachet ORW status.		**(SI):** Angler satisfaction likely remains high.	
Socioeconomics							
Angler benefits and economic value		**(SI):** Slight reduction from current $3.84 million annual value to anglers.		**(SI):** Maintain existing $3.84 million annual value to anglers.	**(SI):** Maintain existing $3.84 million value to anglers.	**(SI):** Maintain existing $3.84 million value to anglers.	**(SI):** Maintain existing $3.84 million value to anglers.
Rafting/boating and "other" recreation economic value	**(SI):** Maintenance of existing $6 million net economic value of recreation benefits.	**(SI):** Net economic value to boaters expected to continue or increase slightly. **(SI):** Current trends of increased economic activity associated with recreation expected to continue. However, decrease in water quality associated with No Action could involve potentially adverse effects to existing angler use & spending, but may be offset by positive effects associated with build-out of residential & vacation units. **(CI):** Maintains current local economies of Big Sky & West Yellowstone. Most significant economic loss likely small reduction in net economic value fishing to anglers from reduced trout catch or trout size.		**(SI):** Maintain current quantity & quality recreation uses along ORW. Current trends of increased economic activity associated with recreation expected to continue. Current annual net economic value of fishing & other river-related recreation maintained. ORW designation could be interpreted as signal of quality, & attract additional anglers over No Action, further increasing economic value of fishing above current level. Net economic value for non-angling, noncommercial recreation days on river continue. **(CI):** Existing angler and other river recreation use levels, river tourism jobs and income maintained.	**(SI):** Maintain current quantity & quality recreation uses along ORW. Current trends of increased economic activity associated with river recreation expected to continue. Current annual net economic value of other river- related recreation maintained. ORW designation could be interpreted as signal of quality, & attract additional visitors over No Action, further increasing economic value above current level. Net economic value for non-angling, noncommercial recreation days on river continue.	**(SI):** Maintain current quantity & quality recreation uses along ORW. Current trends of increased economic activity associated with recreation expected to continue. Current annual net economic value of other river- related recreation maintained. Net economic value for non-angling, noncommercial recreation days on river continue.	**(SI):** Maintain current quantity & quality recreation uses along ORW to extent that narrative exclusions are not granted by DEQ or that advanced wastewater treatment is required in footprint. Existing other river recreation use levels maintained
Tourism related jobs and expenditures		**(SI):** Unknown small losses or small gains to existing 438 jobs & $7.3 million annual out-of-state visitor expenditures.		**(SI):** Maintain existing 438 jobs & $7.3 million annual out-of-state visitor expenditures.	**(SI):** Maintain existing 438 jobs and $7.3 million in annual out-of-state visitor expenditures.	**(SI):** Maintain existing 438 jobs & $7.3 million annual out-of-state visitor expenditures.	**(SI):** Maintain existing 438 jobs & $7.3 million annual out-of-state visitor expenditures.
Recreation employment		**(SI):** Employment with commercial rafting companies continues, & may increase slightly.		**(CI):** Existing net economic values associated with fishing & rafting continue; tourism-related income & employment continue.		**(SI):** Same as Proposed Action.	

Table E-1. Condensed description of potential impacts related to the three alternatives considered in detail in the Gallatin River Outstanding Resource Water Designation Environmental Impact Statement.

Potential Impact **(PI) = Primary** **(SI) = Secondary** **(CI) = Cumulative**	**Common to All Action Alternatives**	**Alternative 1: No Action**	**Alternative 1: No Action with Mitigation Measures**	**Alternative 2: Proposed Action**	**Alternative 2: Proposed Action with Mitigation Measures**	**Alternative 3: Cumulative Impacts Analysis**	**Alternative 3: Cumulative Impacts Analysis with Mitigation Measures**
Construction related employment		**(SI):** Maintain existing jobs in study area.		**(SI):** If standard subsurface wastewater treatment used in new residential & commercial construction in footprint, reduced build-out would result in eventual loss up to 90 jobs in study area and associated $6.86 million per year worker income loss.	**(SI):** If advanced subsurface wastewater treatment is used in new residential & commercial construction in footprint under ORW designation, reduced build-out would result in eventual loss of about 30 jobs in study area and associated $2.3 million per year worker income loss.	**(SI):** Eventual loss up to 90 jobs in study area and associated $6.86 million per year worker income loss unless narrative standards approvals are granted or advanced treatment systems used.	**(SI):** May be similar job loss as under Proposed Alternative, depending on number of narrative standards approvals granted by DEQ.
Other employment sectors		**(SI):** Current level economic activity will maintain current levels direct employment in real estate sector. Associated increase in residents & rental visitors result in small increase income & employment in retail & food services sectors once build-out complete.		**(SI):** Multiplier effects from reduced build-out limitations result in loss up to 30 jobs in real estate, transportation, and local government. **(CI):** Build-out limitations imposed by maintenance of existing water quality would eventually reduce direct employment in construction sectors, and multiplier effects would result in slight reductions in real estate & transportation sectors in study area.	**(SI):** Multiplier effects from reduced build-out limitations result in loss of roughly 10 jobs in real estate, transportation, and local government. **(CI):** Advanced treatment systems would increase build-out potential in footprint & help maintain current levels employment in real estate at slightly lower than current levels. Slight increase employment in property management & waste management services with construction & maintenance more effective treatment systems.	**(SI):** Multiplier effects from reduced construction up to 30 less jobs real estate, transportation, local government unless narrative standards approvals granted or advanced treatment used.	**(SI):** Maintain jobs in real estate, retail & food services depending on advanced water treatment in new homes in footprint and number of narrative standards approvals granted by DEQ.
Property value		**(SI):** Reduction in water quality & aesthetics associated with algae will result in slight decline property values or slow down in rise in property values near ORW. **(SI):** 652 more housing units should moderate rise in house/condo price increases, & thus moderate degree of unaffordability of housing compared to household median income in West Yellowstone & Big Sky.		**(SI):** Protect existing property value differential associated with water quality. Limitations on build-out decrease number of new dwelling units, & may slightly increase prices for existing & new units. Housing affordability slightly worse than under No Action **(CI):** Housing affordability further reduced if demand for housing increases & build-out limited.	**(SI):** Probably slight rise in home values. Housing affordability slightly worse than No Action.	**(SI):** Maintain current value or slightly decrease in values due to uncertainty regarding housing permanence. Housing affordability slightly worse than No Action.	**(SI):** Maintain current value or slightly decrease values in area due to uncertainty regarding housing permanence. Housing affordability slightly than No Action.

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Allowable new homes & commercial space in footprint		**(SI):** 652 dwelling units & 419,000 sq. ft. commercial space.		**(SI):** 75 dwelling units (89% reduction from No Action) and 2,645 sq. ft. commercial space (99% reduction from No action) if new homes and businesses in footprint use conventional water treatment.	**(SI):** Loss of 32% build out in footprint for SFEs, and loss of 96% commercial space development, depending on extent of use of advanced water treatment for new homes/commercial businesses in footprint.	**(SI):** 75 dwelling units (89% reduction from No Action) and 2,645 sq. ft. of commercial space (99% reduction from No Action).	**(SI):** Possible loss in SFEs and commercial space development depending on advanced water treatment for new homes/commercial businesses in footprint or # narrative standards approvals granted by DEQ.
Change in housing costs associated with use of advance wastewater systems		**(SI):** % Change per unit: None $ Change per unit: None Total dollar cost: None		**(SI):** No change to cost per unit if adopted with no mitigation.	**(SI):** % Change per unit: + 1.5% to 2.5% $ Change per unit: $15,700 Total dollar cost: > $6.83 million for study area	**(SI):** % Change per unit: + 1.5% to 2.5% $ Change per unit: $3,200 to $22,000 Total dollar cost: > $1.8 to $11.5 million	**(SI):** % Change per unit: + 1.5% to 2.5% $ Change per unit: $3,200 to $22,000 Total dollar cost: > $1.8 to $11.5 million
Passive use/Existence values to Montana households		**(SI):** Slight loss passive use values of MT residents expected with partial degradation current water quality.		**(SI):** Passive use values (option, existence & bequest values from water quality) to MT residents associated with current water quality maintained.	**(SI):** Passive use values (option, existence & bequest values from water quality) to MT residents associated with current water quality would be maintained.	**(SI):** Passive use values (option, existence and bequest values from water quality) to Montana residents associated with the current water quality would be maintained.	**(SI):** Passive use values (option, existence & bequest values from water quality) to MT residents associated with current water quality would be maintained.
Aquatic Life and Habitats							
TMDL Program	**(CI):** TMDL programs may reduce nutrient loading. Participation & cooperation with TMDLs voluntary for nonpoint sources (septic systems); no way to quantitatively assess potential nutrient load improvements.						
Water quality – phosphorus and nitrogen loading		**(SI):** Increased inorganic phosphorus & nitrogen loading. **(CI):** Potential reduction in flow due to increased well development would diminish overall dilution of nutrients after entering Gallatin River.	**(SI):** Any reductions nutrient levels benefit aquatic community compared to unmitigated No Action Alternative.	**(SI):** Cap on inorganic phosphorus & nitrogen loading.	**(CI):** Potential reduction flow due to increased well development would diminish overall dilution nutrients after entering Gallatin River.	**(SI):** Limit on inorganic phosphorus & nitrogen loading to trigger values as assessed against existing & permitted nutrient inputs.	**(SI):** Total nutrient loading allowed same as the unmitigated Cumulative Impacts Analysis.
Dissolved oxygen and nitrite levels		**(SI):** Potential reduction in dissolved oxygen due to increased algae. Increased nitrogen levels on trout fry expected to reduce trout numbers or size. **(CI):**	**(SI):** Any reductions nutrient levels would benefit aquatic community compared to unmitigated No Action.	**(SI):** Controlled nutrient levels contribute to maintaining existing dissolved oxygen and nitrite levels.		**(SI):** Similar to Proposed Action.	

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		Reduction in available oxygen and increased nitrites.					
Macroinvertebrate community		**(SI):** Shift in composition macroinvertebrate community toward towards more nutrient tolerant community species with less energetic value to trout. Midges continue to be plentiful, but large hatches of caddis, mayflies, and stoneflies may be reduced.	**(SI):** Any reductions nutrient levels benefit aquatic community compared to unmitigated No Action.	**(SI):** Should remain same as current macroinvertebrate community.		**(SI):** Similar to Proposed Action.	
Periphyton and algae		**(SI):** As nutrient levels increase increased algae. Possible adverse aesthetic impacts (e.g. algal blooms) downstream of ORW reach (within ORW reach, cold water temperatures tend to minimize such impacts from increased nutrient levels).	**(SI):** Any reductions in nutrient levels benefit aquatic community compared to unmitigated No Action.	**(SI):** Algal communities remain same as current with no additional nutrients.		**(SI):** Algal communities remain same as current with no additional nutrients.	
Fisheries							
Effects to rare, threatened, and endangered species	**(SI):** No aquatic T&E species in study area. Montana species of concern only incidentally encountered in proposed ORW reach, and its not critical habitat for any Montana species of concern. Impacts to these species not significant.						
Effects to fish habitat		**(SI):** Gradual decline water quality would negatively impact fish community & its habitat. **(CI):** Cumulative impacts to Gallatin River's fishery exacerbated by shifts in periphyton & macroinvertebrate communities. Possible decreased surface water supply due to residential water use inside footprint. Any reduction in total surface flow would reduce available habitat for fish, & diminish overall dilution of nutrients entering Gallatin River.	**(CI):** If mitigation reduces overall nutrient input, impacts to fisheries habitat reduced.	**(SI):** Maintenance existing nutrient levels allow persistence high-quality aquatic habitat. **(CI):** Reductions total future numbers septic systems & residential wells help maintain existing groundwater supplies.	**(SI):** Maintenance existing nutrient levels allow persistence high-quality aquatic habitat. **(CI):** R-Partial reductions total future numbers septic systems & residential wells help maintain existing groundwater supplies.	**(SI):** Minor impacts due to slight increase in nutrient levels.	**(CI):** If mitigation allows increased build-out near or in riparian zone, potential negative impacts to fisheries habitat.

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Fish community - eggs/fry	**(CI):** Unregulated nonpoint sediment sources continue to pose potential threat to incubating eggs & fry.	**(SI):** Increased nitrogen levels expected to reduce trout numbers or trout size. If nitrate levels reach 2.0 mg/L, likely to adversely affect rainbow trout fry and eggs.	**(SI):** Any reductions in nutrient levels benefit fish community compared to unmitigated No Action.	**(SI):** Trout reproduction & recruitment likely to continue at current levels.	**(CI):** If mitigation allows some build-out near riparian zone, possible negative impacts to trout reproduction & recruitment.	**(SI):** Trout reproduction & recruitment likely continue at current levels. Increase nutrient levels not likely significantly different from the Proposed Action.	**(CI):** Impacts likely similar to mitigated Proposed Action.
Fish community - adult		**(SI):** Added stress from increased nitrates; adverse effects on adult growth, reproduction, and survival of fish. If trout carrying capacity decreases, total trout population likely to decrease, or experience reduced growth, increased competition, increased susceptibility to disease, or reduced reproduction success.	**(SI):** Reductions in nutrient levels benefit fish community compared to unmitigated No Action Alternative.	**(SI):** Persistence of existing species diversity & preservation of Gallatin River habitat for salmonids.	**(CI):** If mitigation allows some build-out near riparian zone, possible negative impacts to trout reproduction & recruitment.	**(SI):** Impacts likely similar to Proposed Action.	**(CI):** If mitigation allows increased build-out near riparian zone, possible negative impacts to trout reproduction & recruitment.
Macroinvertebrate community shift		**(SI):** Shift composition trout food base may reduce trout numbers or trout size. Changes in aquatic macroinvertebrate community (food base for trout) potentially reduce growth and total carrying capacity of ORW reach. If food quantity or quality decreases, number trout that grow & thrive decreases.	**(SI):** Any reductions in nutrient levels would benefit fish community compared to unmitigated No Action.	**(SI):** Current macroinvertebrate community likely persists & provide consistent food base for trout.		**(SI):** Impacts likely similar to Proposed Action.	
Terrestrial Vegetation and Habitats							
Development		**(SI):** Increased ground disturbance from retained pace & extent development. **(SI):** Ground disturbance for development of permanent structures result in permanent loss of vegetation. Vegetative disturbances may be short-term if rough graded & soft graded areas revegetated with native species. Removal of existing weed biomass & seed source may be beneficial impact. **(CI):** Removal vegetation within riparian zone may cause		**(PI):** Decreased ground disturbance due to reduction extent of development. **(SI):** Reduction in build out result in less permanent loss of vegetation. Vegetative disturbances may be short-term if rough graded & soft graded areas revegetated with native species. **(CI):** Cumulative impacts same as No Action alternative, but to lesser extent.	**(PI):** Increased ground disturbance from partly retained pace & extent development. **(SI):** Ground disturbance for development permanent structures would result in permanent loss of vegetation. Vegetative disturbances may be short-term if rough graded & soft graded areas revegetated with native species. Removal existing weed biomass and seed source may be beneficial impact. **(CI):** Removal vegetation within riparian zone may cause cumulative impacts on water	**(SI):** Decreased ground disturbance due to reduction in extent of development. **(SI):** Reduction build out result in less permanent loss of vegetation. Vegetative disturbances may be short-term if rough graded &soft graded areas revegetated with native species. **(CI):** Cumulative impacts same as No Action, but to lesser extent.	**(SI):** Increased ground disturbance from retained pace & extent development. **(SI):** Ground disturbance for development of permanent structures result in permanent loss of vegetation. Vegetative disturbances may be short-term if rough graded & soft graded areas revegetated with native species. Removal existing weed biomass & seed source may be beneficial

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		cumulative impacts on water catchment, infiltration, & delivery from rain. These changes in soil water content & water availability negatively affect vegetation but may benefit some noxious weeds.			catchment, infiltration, & delivery from rain. These changes in soil water content & water availability negatively affect vegetation but may benefit some noxious weeds.		impact. **(CI):** Removal vegetation within riparian zone may cause cumulative impacts on water catchment, infiltration, & delivery from rain. These changes in soil water content & water availability negatively affect vegetation but may benefit some noxious weeds.
Native plant communities		**(SI):** Native plant communities may be permanently altered or replaced with nonnative species, creating fragmented native habitat. Revegetated areas require time for vegetation to reestablish. **(CI):** Fragmentation could impact overall plant productivity and wildlife use. Fragmentation can impact size and proximity of habitat patches, increase amount of habitat edge, ultimately impacting quality of habitat for birds and mammals.		**(SI):** Native plant communities may be permanently altered or replaced with non-native species, creating fragmented native habitat. Revegetated areas require time for vegetation to reestablish. Impacts reduced if less development occurs. **(CI):** Same as No Action, but to lesser extent.	**(SI):** Native plant communities may be permanently altered or replaced with nonnative species, creating fragmented native habitat; probably less than under No Action. Revegetated areas require time for vegetation to reestablish. **(CI):** Fragmentation could impact overall plant productivity and wildlife use. Fragmentation can impact size and proximity of habitat patches, increase amount of habitat edge, ultimately impacting quality of habitat for birds and mammals.	**(SI):** Native plant communities may be permanently altered or replaced with non-native species, creating fragmented native habitat. Revegetated areas require time for vegetation to reestablish. Impacts reduced if less development occurs. **(CI):** Same as No Action, but to lesser extent.	**(SI):** Native plant communities may be permanently altered or replaced with nonnative species, creating fragmented native habitat. Revegetated areas require time for vegetation to reestablish. **(CI):** Fragmentation could impact overall plant productivity and wildlife use. Fragmentation can impact size and proximity of habitat patches, increase amount of habitat edge, ultimately impacting quality of habitat for birds and mammals.
Effects to rare, threatened, and endangered species		**(PI):** Potential removal of slender Indian paintbrush plants. **(SI):** Impacts from noxious weeds on species of concern include potential increased competition, displacement, & plant damage or mortality resulting from herbicide drift during weed management. **(CI):** Impacts on species of concern vary. Potential impacts caused by development & other ground disturbances could affect species		**(SI):** Could limit number of future dwelling units and commercial properties. Impacts to plants of concern are less likely. **(CI):** Same as No Action, but to lesser extent.	**(PI):** Potential removal of slender Indian paintbrush plants. **(SI):** Impacts from noxious weeds on species of concern include potential increased competition, displacement, & plant damage or mortality resulting from herbicide drift during weed management. **(CI):** Impacts on species of concern vary. Potential impacts caused by development & other ground disturbances could affect species	**(SI):** Could limit number of future dwelling units and commercial properties. Impacts to plants of concern are less likely. **(CI):** Same as No Action, but to lesser extent.	**(PI):** Potential removal of slender Indian paintbrush plants. **(SI):** Impacts from noxious weeds on species of concern include potential increased competition, displacement, & plant damage or mortality resulting from herbicide drift during weed management. **(CI):** **I**mpacts on species of

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		ability to persist, & vulnerabilities to extinction in Montana.			ability to persist, & vulnerabilities to extinction in Montana.		concern vary. Potential impacts caused by development & other ground disturbances could affect species ability to persist, & vulnerabilities to extinction in Montana.
Slender Indian paintbrush		**(PI):** Potential removal slender Indian paintbrush plants. **(SI):** This species vulnerable to hydrologic alterations if water table lowered by increased number of wells. Will incur greatest impacts from future development since occurs on private lands that are partially developed. Distribution & abundance could suffer from increased invasion noxious weeds. **(CI):** Any loss in abundance or habitat for slender Indian paintbrush probably not affect ability to persist in Gallatin County.		**(SI):** Vulnerability to hydrologic alterations reduced due to fewer SFEs & thus fewer wells. Direct impacts to slender Indian paintbrush less likely. Because occurrences next to existing roads & trails, degree of secondary impacts same as under No Action. Habitat could experience impacts from noxious weed spread. **(CI):** Impacts on slender Indian paintbrush would not affect ability to persist in Gallatin County.	**(PI):** Potential removal slender Indian paintbrush plants. **(SI):** This species vulnerable to hydrologic alterations if water table lowered by increased number of wells. Will incur greatest impacts from future development since occurs on private lands that are partially developed. Distribution & abundance could suffer from increased invasion noxious weeds. **(CI):** Any loss in abundance or habitat for slender Indian paintbrush probably not affect ability to persist in Gallatin County.	**(SI):** Vulnerability to hydrologic alterations reduced due to fewer SFEs & thus fewer wells. Direct impacts to slender Indian paintbrush less likely. Because occurrences next to existing roads & trails, degree of secondary impacts same as under No Action. Habitat could experience impacts from noxious weed spread. **(CI):** Impacts on slender Indian paintbrush would not affect ability to persist in Gallatin County.	**((PI):** Potential removal slender Indian paintbrush plants. **(SI):** This species vulnerable to hydrologic alterations if water table lowered by increased number of wells. Will incur greatest impacts from future development since occurs on private lands that are partially developed. Distribution & abundance could suffer from increased invasion noxious weeds. **(CI):** Any loss in abundance or habitat for slender Indian paintbrush probably not affect ability to persist in Gallatin County.
Hall’s rush		**(SI):** Distribution & abundance could suffer from increased invasion noxious weeds. **(CI):** Ability persist in Gallatin County may be reduced. Overall viability in Montana &global range not impacted.		**(SI):** Habitat could experience impacts from noxious weed spread. **(CI):** Same as No Action, but to lesser extent.	**(SI):** Distribution & abundance could suffer from increased invasion noxious weeds. **(CI):** Ability persist in Gallatin County may be reduced. Overall viability in Montana &global range not impacted.	**(SI):** Habitat could experience impacts from noxious weed spread. **(CI):** Same as No Action, but to lesser extent.	**(SI):** Distribution & abundance could suffer from increased invasion noxious weeds. **(CI):** Ability persist in Gallatin County may be reduced. Overall viability in Montana &global range not impacted.
Large-leafed balsamroot		**(SI):** Distribution & abundance could suffer from increased invasion noxious weeds. **(CI):** Ability persist in Gallatin County may be reduced. Overall viability in Montana &global range not impacted.		**(SI):** Habitat could experience impacts from noxious weed spread. **(CI):** Same as No Action, but to lesser extent.	**(SI):** Distribution & abundance could suffer from increased invasion noxious weeds. **(CI):** Ability persist in Gallatin County may be reduced. Overall viability in Montana &global range not impacted.	**(SI):** Habitat could experience impacts from noxious weed spread. **(CI):** Same as No Action, but to lesser extent.	**(SI):** Distribution & abundance could suffer from increased invasion noxious weeds. **(CI):** Ability persist in Gallatin County may be reduced. Overall viability in

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							Montana &global range not impacted.
Discoid goldenweed		**(SI):** Distribution & abundance could suffer from increased invasion noxious weeds. **(CI):** Potential impacts caused by development & other ground disturbances could increase vulnerability to extinction in Montana, but not global viability.		**(SI):** Habitat could experience impacts from noxious weed spread. **(CI):** Same as No Action, but to lesser extent.	**(SI):** Distribution & abundance could suffer from increased invasion noxious weeds. **(CI):** Potential impacts caused by development & other ground disturbances could increase vulnerability to extinction in Montana, but not global viability.	**(SI):** Habitat could experience impacts from noxious weed spread. **(CI):** Same as No Action, but to lesser extent.	**(SI):** Distribution & abundance could suffer from increased invasion noxious weeds. **(CI):** Potential impacts caused by development & other ground disturbances could increase vulnerability to extinction in Montana, but not global viability.
Noxious weeds		**(SI):** Future development has potential to increase area & density of infestations. Soil brought in for development may provide better habitat for weeds than native soil. If development spreads weed seed to new areas, weeds become a problem on additional public & private lands. Conversely, removal existing weed biomass & seed source may be beneficial. **(CI):** Cumulative impacts of noxious weed spread may include declines in native plant community diversity, increased sedimentation, & decreased wildlife or livestock forage.		**(SI):** Reduced development result in less ground disturbance (assuming no mitigation), thus secondary impacts of noxious weed spread lower. **(CI):** Cumulative impacts noxious weed spread may include declines native plant community diversity, increased sedimentation, & decreased wildlife or livestock forage.	**(SI):** Future development has potential to increase area & density of infestations, probably less than with No Action. Soil brought in for development may provide better habitat for weeds than native soil. If development spreads weed seed to new areas, weeds become a problem on additional public & private lands. Conversely, removal existing weed biomass & seed source may be beneficial. **(CI):** Cumulative impacts of noxious weed spread may include declines in native plant community diversity, increased sedimentation, & decreased wildlife or livestock forage.	**(SI):** Reduced development result in less ground disturbance (assuming no mitigation), thus secondary impacts of noxious weed spread lower. **(CI):** Cumulative impacts noxious weed spread may include declines native plant community diversity, increased sedimentation, & decreased wildlife or livestock forage.	**(SI):** Future development has potential to increase area & density of infestations. Soil brought in for development may provide better habitat for weeds than native soil. If development spreads weed seed to new areas, weeds become a problem on additional public & private lands. Conversely, removal existing weed biomass & seed source may be beneficial. **(CI):** Cumulative impacts of noxious weed spread may include declines in native plant community diversity, increased sedimentation, & decreased wildlife or livestock forage.
Wildlife							
Wildlife - general	**(PI):** No primary impacts to wildlife.	**(SI):** If eutrophication reduces fish or invertebrate productivity or changes species composition, fish-eating (river otter, bald eagle, osprey or mergansers) or insect-eating (shrews, swallows or warblers) wildlife may be	**(SI):** Using alternative water treatment so no negative effects on aquatic ecology; would be no impacts to wildlife from reduced water quality. **(CI):** Zoning, planning development with wildlife habitat as focus, and	**(SI):** Secondary impacts to wildlife may be beneficial. Proposed Action represents the potential for an overall 89% reduction in allowable dwelling units & 99% reduction in commercial square footage (less	**(SI):** Mitigation would partly reduce build-out compared to No Action. Partial benefits to wildlife due to reduced land use in footprint.	**(SI):** Impacts to wildlife likely intermediate between Proposed Action & No Action. Magnitude of impact depends on use of narrative standard, approval of application to degrade. If surge in development occurs early on,	**(SI):** Impacts with mitigation would be intermediate to impacts with mitigation from the No Action & Proposed Action alternatives.

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		affected by change in prey base. **(CI):** Habitat losses from increased development combined with other habitat losses & increased encroachment on wildlife habitat may cumulatively affect wildlife by reducing long-term population viability. Species less compatible with humans (grizzly bear) or those requiring larger areas contiguous habitat; more likely affected.	implementing & enforcing food & garbage storage policies could reduce impacts to wildlife from increased development.	habitat loss), as well as long term protection of water quality. **(CI):** Any impacts beneficial relative to No Action.		& DEQ's continued adherence to Cumulative Impacts Analysis. **(CI):** Likely similar to Proposed Action & beneficial compared to No Action.	
Habitat		**(SI):** Increased development could cause habitat loss, habitat fragmentation, & increased disturbance by humans. Fragmentation plant communities detrimental to plant productivity & therefore wildlife use. Higher density development translates to more disturbances to wildlife, through traffic, domestic pets, & general human activity.		**(SI):** Less loss of habitat with less development, beneficial for wildlife.		**(SI):** Impacts to wildlife likely intermediate between Proposed Action & No Action. Magnitude of impact depends on use of narrative standard, approval of application to degrade. If less loss of habitat with less development, beneficial for wildlife.	
Effects to rare, threatened, and endangered species		**(SI):** Bald eagles could be negatively affected if No Action Alternative results in degraded water quality & reduction in prey base. Grizzly bears could be affected by increased human development & use in bear habitat. Effects to wolves or lynx not likely significant or measurable.		**(SI):** Would not adversely affect federally listed wildlife species, & may have beneficial effects. If Proposed Action results in lower dwelling unit density, loss of habitat & human disturbance less than under the No Action. Preservation water quality beneficial to bald eagles & indirectly to other species.		**(SI):** Would not adversely affect federally listed wildlife species, & may have beneficial effects. If Cumulative Impacts Analysis results in lower dwelling unit density, loss of habitat & human disturbance less than under the No Action. Preservation water quality beneficial to bald eagles & indirectly to other species.	
Air Quality							
	(SI): Some gradual decrease in air quality as level of development in Gallatin Canyon increases.			**(SI):** May limit development, & therefore less air pollution from fewer future construction activities.	**(SI):** If mitigations implemented, partial reduction development potential in footprint & subsequent impacts to air quality less compared to No Action.		

Table E-1. Condensed description of potential impacts related to the three alternatives considered in detail in the Gallatin River Outstanding Resource Water Designation Environmental Impact Statement.

Potential Impact **(PI) = Primary** **(SI) = Secondary** **(CI) = Cumulative**	**Common to All Action Alternatives**	**Alternative 1: No Action**	**Alternative 1: No Action with Mitigation Measures**	**Alternative 2: Proposed Action**	**Alternative 2: Proposed Action with Mitigation Measures**	**Alternative 3: Cumulative Impacts Analysis**	**Alternative 3: Cumulative Impacts Analysis with Mitigation Measures**
Cultural Resources							
	(PI): No primary impacts to cultural resources likely. **(CI):** Possibly cumulative impacts to cultural resources.	**(SI):** Impacts cultural resources within study area due to ground disturbance during site development. Entire study area has not been surveyed; therefore, total number & distribution sites currently not known. However, given existing documentation, reasonable to assume some disturbance of cultural sites.		**(SI):** With less development, less ground disturbance and lowered impacts to cultural resources.	**(SI):** If mitigations adopted, Proposed Action will present secondary impacts similar to those under No Action.	**(SI):** If less development, less ground disturbance and lowered impacts to cultural resources.	
Aesthetics							
Visual resources	**(PI):** None. **(CI):** No effects to visual character or appearance of surrounding viewsheds or topography.	**(SI):** Aesthetic impacts from increased development primarily noticeable in commercial & residentially zoned areas. Density of development may impact aesthetic quality of the corridor near highway. **(CI):** Development could continue to full build-out; could impair aesthetic quality of river corridor near highway.		**(SI):** Substantially reduced level from No Action. Reduction in density of development would protect aesthetic quality of river corridor. **(CI):** Future development could impair aesthetic quality of river corridor near highway, but reduced from No Action.	**(SI):** Impacts similar as No Action. **(CI):** Development to less than full build-out, which could create less impairment aesthetic quality of river corridor near highway.	**(SI):** Substantially reduced level from No Action. Reduction in density of development would protect aesthetic quality of river corridor. **(CI):** Future development could impair aesthetic quality of river corridor near highway, but reduced than No Action.	**(SI):** Impacts same as No Action. **(CI):** Development to full build-out, which could impair aesthetic quality of river corridor near highway.

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Chapter 1: Introduction to the Final EIS

Under the Montana Environmental Policy Act (MEPA), the intent of the Final Environmental Impact Statement (FEIS) is to summarize comments and participation from the public and interested agencies regarding the adequacy, direction, breadth, and extent of the analysis contained in a Draft Environmental Impact Statement (DEIS). Comments are evaluated based on their content, relevance, and jurisdiction of DEQ and associated agencies. Public comments may redirect the analysis or require new analyses. MEPA requires agencies to include in the FEIS all comments, or if not practical, a representative sample of comments and the agency's response to all substantive comments. Copies of all comments received on the DEIS for the Gallatin River Outstanding Resource Water (ORW) designation are found in Appendix A of this document. The DEIS is adopted as final with amendments made in response to public comments.

This FEIS summarizes comments received by DEQ during the comment period for the Gallatin ORW DEIS. This comment period encompassed 49 days from September 8, 2006 to October 27, 2006 (MEPA requires a minimum of a 30 day comment period.) Each comment was classified by the resource area addressed, and then forwarded to the appropriate specialist for assessment. Resource specialists read each comment, and responded with a brief analysis of how the DEIS addressed the comment, or when necessary, with additional analyses to answer the comment. Some comments requested analysis beyond the scope of the EIS, outside of the jurisdiction of DEQ, or inconsistent with the legal framework associated with the ORW petitioning process. These comments are catalogued in this report, but no further analysis was completed.

DEQ will recommend in a Record of Decision (ROD) a course of action for the Montana Board of Environmental Review (Board). The ROD is a concise public notice of DEQ's decision, explaining the reasons for the decision and any special conditions surrounding the decision or its implementation (Mundinger and Everts 2004). The Board will then make a decision on rulemaking. The Board may, based on DEQ's ROD, choose to proceed with the proposed rule (adopt the Proposed Action Alternative), decline to adopt the rule (adopt the No Action Alternative), or modify the proposed rule and send it out for further public comment. If the Board decides to decline the rule, the Board must identify its reasons. If the Board decides to move forward with the rule as proposed, the Board will finalize the rule to classify the specified reach of the Gallatin River as an ORW. The rule would then be adopted, but is not effective until approved by the Legislature (75-5-316(9), MCA). Throughout this entire process, DEQ has complied with MEPA's requirement for scheduling, open disclosure and reasonable provisions for the involvement of the public in the EIS process as detailed in Chapter 3.

Chapter 2: Analysis of Comments

Sixty-seven individuals or entities submitted comments to DEQ during the public comment period on the DEIS, and of these, nineteen commented at the October 25, 2006 public hearing. The majority of comments came from individual citizens. Twenty-two comments were received from agencies, law firms, and non-governmental organizations. Several commenters addressed more than one topic or resource area in their submittals. Thirteen of the individual comment letters received expressed support for the designation, but did not request specific direction or analyses in the FEIS. Similarly, two individual comments expressed opposition for the designation, but did not request specific direction or analysis. These comments were duly noted, but no other response was required. The remaining comment letters contained at least one substantive issue that is addressed in this FEIS. The comments have been sorted by resource area, and substantive comments have been addressed within these areas. No comments were received regarding the following resource areas: vegetation, wildlife, aesthetics, and cultural resources; therefore, no further analysis specific to these resource areas was necessary.

Where appropriate, section numbers, page numbers, or figure and table numbers from the DEIS as published by DEQ are included to assist the reader. These page numbers refer to the locations of any changed text, figures or tables in the DEIS, or direct the reader to places in the DEIS used to address a comment. New tables and analyses are accompanied by a reference to an approximate insertion point in the DEIS. Introductory material has been included to allow this document to stand alone as a summary of the changes to the DEIS. However, the FEIS does not replace the DEIS which contains the bulk of the analyses used to evaluate the alternatives.

2.1 Geology and Soils

Several comments were recorded at the October 25, 2006 public hearing and at least five additional comments were received by DEQ on issues regarding the analysis of the geology and soils related to the footprint in the DEIS. The comments generally fell into two areas: regulating nonpoint source discharges and the use of Best Management Practices.

2.1.1 Comment Summary

There were five comments related to geology and soils. One organization commented that impacts to timber harvesting and mining impacts were not addressed. Similarly, concerns were expressed related to nonpoint source activities, and whether highway maintenance activities would be affected. One commenter stated that Best Management Practices should handle soil disturbances due to any increased development in the study area. One commenter pointed out (correctly) that nonpoint sources will not be affected by ORW designation.

2.1.2 Issues Raised and Responses

Comment 1: The comments on soils and geology all referenced activities which will not be regulated differently under ORW designation than under current regulations. One comment also refers to section 2.3 of the DEIS and to 75-5-303, MCA. The commenter is unsure whether the ORW designation will curtail temporary degradation of state waters.

Response: Nonpoint source activities will not be regulated under the ORW designation.

Nonpoint Source Discharges: Montana Department of Transportation projects, such as road construction and maintenance, which produce nonpoint source pollutants will not be controlled differently under the ORW designation (75-5-316, MCA); refer to the definition of point source (75-5-103, MCA). These sources of pollutants not affected by ORW designation were addressed in the DEIS, Section 1.9, page 9. Silviculture and agriculture activities that are nonpoint sources are not controlled differently under the ORW designation, than without ORW designation (Section 1.9 of the DEIS).

There is currently no provision in 75-5-303, MCA, for “temporary degradation”; therefore, the proposed alternative will not change how temporary degradation is addressed. The nonsignificant activities that are listed in 75-5-317, MCA, will not be affected by ORW designation, since they are specifically exempted from the provisions of 75-5-303, MCA.

Mining Activities: While the DEIS stated there were no existing or planned mining operations in the ORW study area (P. Werner, pers. comm. 2006), (Section 3.4.3.2 of the DEIS), recent research shows there are two sand and gravel mine operations in the Big Sky area. These sand and gravel mines are commented on under land use in Section 2.3.2 of the FEIS.

2.2 Water Quality

Several comments were recorded at the October 25, 2006 public hearing and at least twenty-seven additional comments were received by DEQ on issues regarding the water quality impacts analysis related to the footprint. The comments generally fell into six areas: types of specific activities affected by ORW designation; current policy protecting water quality including TMDLs and water quality trends; water quality impacts analysis; the extent of ORW designation; mitigation measures; and the footprint of hydrologic connection.

2.2.1 Comment Summary

2.2.1.1 Specific Activities Affected by the ORW Designation

Comments asked specifically which activities would be affected by the ORW designation. One commenter stated that the DEIS did not appear to recognize the presence of the Gallatin Local Water Quality District, or to address potential impacts of the ORW designation to the Gallatin Local Water Quality District.

2.2.1.2 Current Policy and the Protection of Water Quality and Water Quality Trends

Thirteen individuals commented on existing water quality being protected by current policy or on the presence of measurable impacts. Many stated they thought water quality in the Gallatin River was adequately protected without ORW designation, while several commented they thought the river was not adequately protected from water quality degradation.

One commenter stated that there was no analysis of impacts from leaks from the Big Sky Water and Sewer District affecting water quality.

2.2.1.3 Water Quality Impacts Analysis

Nine people had comments or questions concerning the vulnerability footprint map and/or hydrologic connection. They generally wanted to know how the map was derived, and whether or not it had regulatory status.

2.2.1.4 Extent of the ORW

Several commenters made statements regarding flexibility of the ORW designated area. One commenter stated that the ORW was too weak, and would not protect water quality enough.

2.2.1.5 Mitigation Measures

Two commenters questioned whether full build-out could be achieved using proposed mitigation measures. Air quality as a result of specific mitigation measures (incinerator toilets) was a concern of one commenter. This comment is addressed under Air Quality, Section 2.7 of the FEIS.

2.2.1.6 Existing Regulation of Hydrologically Connected Groundwater

One comment addressed the possibility of conflicting hydrogeological evaluations during the hydrologic connectivity review as part of the nondegradation assessment.

2.2.2 Issues Raised and Responses

This section presents the issues raised and their responses based on the follow six areas presented above: types of specific activities affected by ORW designation; current policy protecting water quality including TMDLs and water quality trends; water quality impacts analysis; the extent of ORW designation; mitigation measures; and the footprint of hydrologic connection.

2.2.2.1 Specific Activities Affected by the ORW Designation

Comment 2: Several comments inquired as to which activities would be affected under ORW designation and, specifically, whether parcels with septic permits or approvals would be subject to new requirements under the Proposed Alternative.

Response: As stated earlier, the ORW designation only curtails measurable change from regulated point sources; nonpoint sources are not included. Refer also to Section 2.1.2 Issues Raised and Responses in the Geology and Soils Section of the FEIS.

ORW regulation does not apply to new or increased sources of pollution with a direct hydrologic connection to an ORW if the source was approved, authorized, licensed, or permitted by DEQ or a local government body prior to the effective date of the ORW designation, as outlined in the proposed ARM 17.30.617 Outstanding Resource Water – Designation.

Other Direct Discharges or Proposed Direct Discharges:

Comment 3: One commenter asked how many direct discharge permits (MPDES) were found in the area.

Response: Montana Pollutant Discharge Elimination System (MPDES) permits outlined in Section 3.3.3.1 of the DEIS shows four MPDES permits. There are two storm water permits and one MPDES permit, all near Big Sky, and one storm water permit in Upper Hell Roaring Creek.

There are two sand and gravel mining operations in the ORW study area. Neither facility has a listed MPDES permit, as outlined above, and there are no known discharges to surface water from either of the facilities.

Comment 4: One comment stated that the DEIS did not appear to recognize the presence of the Gallatin Local Water Quality District, or to address potential impacts of ORW designation to this District.

Response: The Cumulative Impacts Analysis Alternative, and to a greater extent the Proposed Action, should decrease transport of nutrients to and in the southern portion of the Gallatin Local Water Quality District by evaluating cumulative effects and measurable changes to water quality in the Gallatin River (the southern part of the District extends approximately 9.5 miles into the northern part of the proposed ORW segment). Development within the areas hydrologically connected to the Gallatin River will be affected in a similar fashion under ORW designation, whether they are inside or outside the Gallatin Local Water Quality District.

2.2.2.2 Current Policy and the Protection of Water Quality

Current Policy and Cumulative Impacts:
Comment 5: A number of commenters stated that they thought current policy was protective enough of water quality in the ORW.

Response: DEQ currently has the authority to regulate and implement a cumulative impacts analysis in any watershed in the state; however, the level and pace of development in most watersheds across Montana has not necessitated surface water cumulative impacts analysis in order to effectively protect water quality. (Section 2.4 DEIS)

Nondegradation Review:
Comment 6: At least one commenter stated that attenuation of pollutants such as phosphorus and nitrogen as they move through groundwater was not considered. Several commenters stated that they thought current nondegradation policy was protective of water quality in the Gallatin River.

Response: For sources adjacent to surface waters, current nondegradation reviews of Subsurface Wastewater Treatment Systems (SWTSs) for nitrate (as N) are evaluated based on meeting the nondegradation significance limits. Using the trigger values for each nutrient, inorganic phosphorus or nitrate (as N), the dilution equation is applied to determine if the source results in a measurable, or trigger value, change above existing background concentrations. The current background concentration is not considered because only the incremental measurable change is evaluated. If the source causes an exceedance in the trigger value for nitrate (as N), the applicant has the option of demonstrating compliance with the narrative standard for nitrate (as N) in ARM 17.30.715(1)(g), which states that changes in water quality for any parameter having only a narrative standard will not have a measurable effect on any existing or anticipated use or cause measurable changes in aquatic life or ecological integrity.

Also, if the proposed source does not meet the 50-year break-through[1] limit for inorganic phosphorus, the proposed discharge cannot cause an increase above the trigger value for inorganic phosphorus. If the trigger value is exceeded as a result of the dilution equation evaluation, the applicant could demonstrate that the increase in phosphorus in the surface water would not be significant based on the narrative standard [ARM 17.30.715(1)(g)].

In the trigger value evaluation using the dilution equation, DEQ assumes that 100% of the effluent discharged from the SWTS will reach the surface water unless supporting data can be provided that shows a lower loading percentage. The trigger value evaluation is currently used for each individual activity and is not applied to cumulative effects of multiple activities, such as multiple, unrelated subdivisions. However, DEQ does have the authority to regulate new developments based on cumulative impacts analysis to high quality water bodies [ARM 17.30.506(2)(f) and 17.30.715(2)(a)].

The ORW designation would protect water quality from cumulative regulated discharges with regards to the trigger values, and would eliminate the use of the narrative standard. Under the current nondegradation review for SWTS, a 50-year break-through criterion is used for inorganic

[1] The travel time limit for a pollutant from its source to receiving waters, in this case 50 years.

phosphorus nondegradation analysis. Thus, using the current analysis procedure, permitted septic systems could allow inorganic phosphorus break-through to the surface water at any time greater than 50 years, where cumulative effects are not evaluated. The Proposed Action would provide additional protection by evaluating cumulative impacts of multiple sources to the Gallatin River.

Water Quality Trends and Background:

Comment 7: Several commenters stated that no impacts to water quality are currently seen in the Gallatin River mainstem. One commenter noted that Storm Castle Creek has never been listed on the 303(d) listed for impaired waterbodies.

Response: The requirements for ORW designation do not require a finding that the water body is impacted or impaired. But, rather that the water body is at risk of having at least one of the criteria listed in 75-5-316(4), MCA, compromised as a result of pollution. Data suggesting impacts are occurring are provided below to demonstrate that risk.

Modeling data in support of a nonsignificance determination have shown potential increases in algae concentration along the South Fork and West Fork of the Gallatin River as a result of one proposed development. Estimated levels of algae growth were shown to increase as much as 3.1% at the mouth of South Fork due to increases of the projected nitrate loading of the development. (Section 4.3.1.2 DEIS and Nicklin 2000b)

The Blue Water Task Force data collected from May 2000 to February 2004 along the Gallatin River and some of its tributaries, as presented in Section 4.3.1.2 of the DEIS, indicate higher nitrate concentrations in the West Fork of the Gallatin River (which is the tributary with the largest discharge and highest intensity of development in the area of the ORW) than the Gallatin River above the West Fork confluence. This result suggests a measurable change in nutrients increase in areas of higher intensity of development.

TMDL assessments have classified several designated uses as threatened in six tributaries: Storm Castle and Cache creeks, the Taylor Fork, West Fork, South Fork, and Middle Fork of the West Fork of the Gallatin River (DEQ 2006a, EPA 2005). The following list includes impairments due to nutrients as well as other causes:

- In 2004, Storm Castle Creek (MT41H005_010), formerly known as Squaw Creek, (which is the name used in the 303(d) lists) was 303(d) listed as only partially supporting aquatic life and coldwater fish due to bank erosion, fish habitat degradation, other habitat alterations and nutrients.

- Taylor Fork (MT41H005_020) was not listed as impaired on the 1996 303(d) list, but did appear on the 2004 303(d) list. In 2004, Taylor Fork was listed as only partially supporting aquatic life, coldwater fishery, and industry due to siltation, fish habitat degradation, suspended solids, and other habitat alterations.

- Cache Creek (MT41H005_030) was listed as impaired on the 1996 303(d) list due to siltation, which was impairing aquatic life and coldwater fish. In 2004, Cache Creek

was listed as only partially supporting aquatic life and coldwater fishery due to siltation, other habitat alteration, and suspended solids.

- In 2004, the Middle Fork of the West Fork of the Gallatin River (MT41H005_050) designated use – recreation – was added as being only partially supported due to impairments caused by nutrients, bank erosion, pathogens, suspended solids, and other habitat alteration. In 2006 this river segment was downgraded from partially supporting to non-supporting contact recreation (DEQ 2006c, Pg D-22).

- South Fork of the West Fork (MT41H005_060) was on the 2004 303(d) list due to impairments caused by nutrients, bank erosion, pathogens, suspended solids, and other habitat alterations.

- In 2004 for the West Fork of the Gallatin River (MT41H005_040), recreation was added as partially supported designated use on the 2004 303(d) list and the following causes were cited: nutrients, siltation, and algal growth (as indicated by chlorophyll *a* measurements). (Section 3.3.3.1 DEIS). The 2006 DEQ 303(d) report shows the West Fork Gallatin River as downgraded from partial support to nonsupport for cold water fishery and for contact recreation. DEQ's summary impairment comments on the West Fork included the following: "Nutrient enrichment and sedimentation negatively impact aquatic life and recreational uses. There is evidence that the stream is being colonized by *Tubifex tubifex*, the intermediate host for whirling disease and a species tolerant of sediment and nutrient pollution. Aquatic Life: CHEMISTRY - moderate impairment due to nutrient enrichment; HABITAT - moderate impairment due to sedimentation, Cold Water Fishery: Nutrient enrichment, sedimentation, nuisance algal growth."

Baldwin (1997) found that, of 21 domestic and five public water wells sampled in the Big Sky area, nutrient concentrations were always below the maximum contaminant level of 10 mg/L. His results showed levels of nitrate as high as 3.86 mg/L and was believed to be affected by septic system effluent in groundwater. (Section 3.3.3.2 DEIS)

DEQ finds this progression of water quality information strongly suggests that water quality degradation is occurring in the tributaries of the proposed ORW reach, and thus puts the quality of water in the Gallatin River at risk.

2.2.2.3 Water Quality Impacts Analysis
The Footprint Map (DEIS Figure 2.2-1):

Comment 8: Several commenters asked how the map of the footprint was developed, how its location was determined, and exactly how it would be used. Commenters wanted to know if the footprint would be used in a regulatory manner.

Response: The footprint map (Figure 2.2-1) was an assessment tool used in the DEIS evaluation to delineate the geographic area likely to be hydrologically connected to the Gallatin River and

its tributaries. The assessment criteria included estimated depth to groundwater, groundwater time of travel to the streams, geologic maps, and previously published scientific studies of the Gallatin River area. The footprint map was developed to estimate the surficial extents of a vulnerable area within which contaminants released to the subsurface may contribute to water quality impacts in the Gallatin River. Areas within the footprint were estimated as having potential to impact surface waters based on the available published information and scientific interpretation. However, the footprint map does not verify that development within the footprint will have direct water quality impacts to the river. Site-specific evaluation would be required to verify whether a particular site was, in fact, hydrologically connected to Gallatin River surface waters.

Development of the vulnerability footprint map was necessary to perform the assessment of potential impacts to land use and socioeconomic issues as required in the development of the DEIS. The footprint was not developed for direct regulatory use, although it may be used as a starting point by the public and by agencies in conjunction with nondegradation reviews. As indicated in the Notice for the Public Hearing, the Board of Environmental Review is proposing to amend ARM 17.30.617 to designate the specific mainstem section of the Gallatin River as an ORW and to amend ARM 17.30.638 (1) to add a new subsection clarifying that discharges to ground water with a direct hydrologic connection to an ORW fall within the statutory mandate prohibiting any permanent change in the water quality of an ORW resulting from point source discharges. Thus, the Proposed Action is based on “direct hydrologic connection”, and not on the footprint or its map (Figure 2-1) in the DEIS.

In response to the comment that the footprint is abrupt in its assumption of contaminants reaching the Gallatin River, the footprint setback is not unlike many other regulatory setbacks that utilize a single line to protect resources and human health. The DEIS could have proposed multiple footprint lines with varying percentages of wastewater discharged within each line assumed to reach the Gallatin, but that would have increased complexity of the footprint. DEQ does not believe that there were sufficient data available to propose a more complex scenario of multiple footprint boundaries within the ORW.

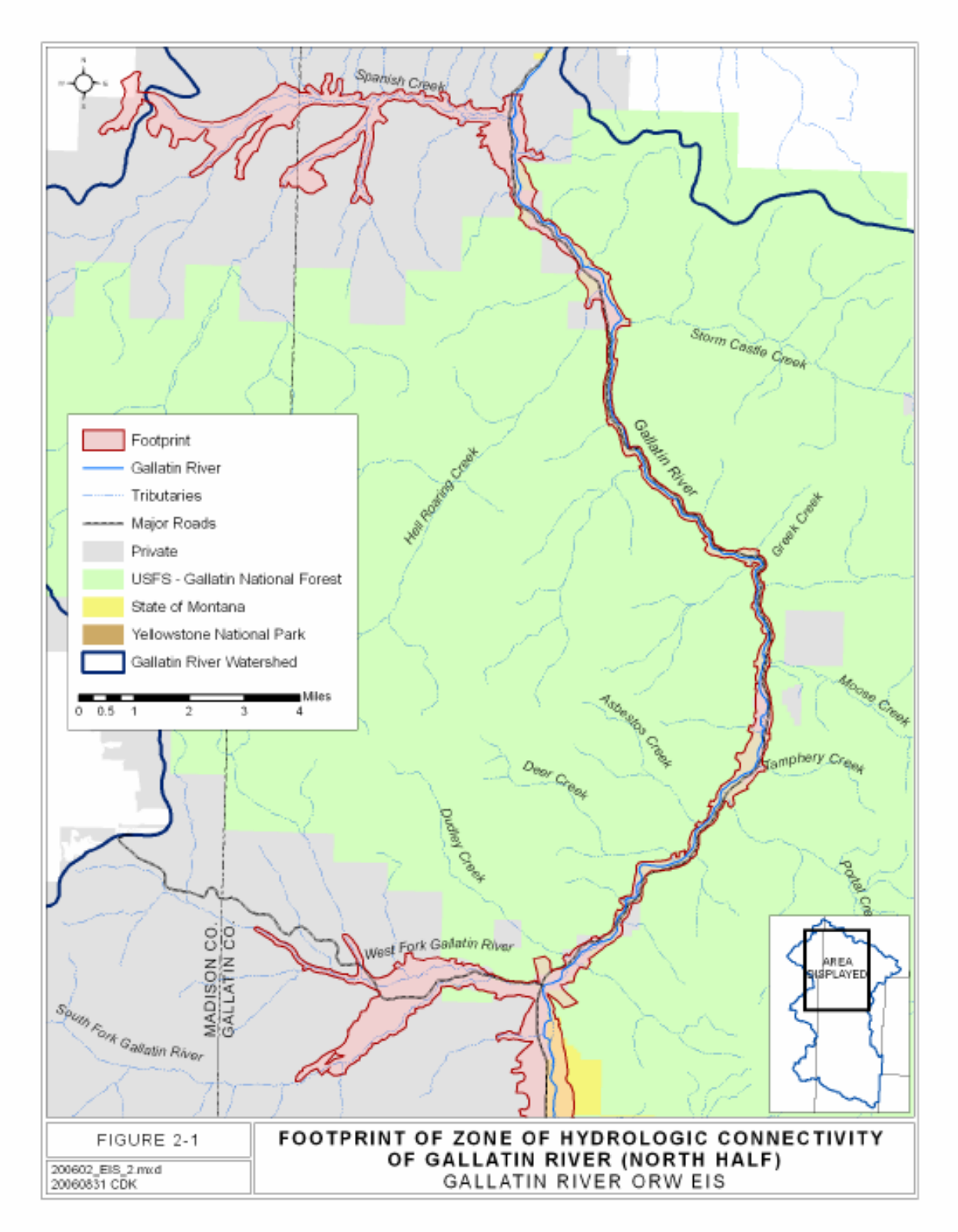

Figure 2.2-1. Map showing the footprint of the area hydrologically connected to the mainstem of the Gallatin River based on a one-year groundwater travel time. (Identical to Figure 2-1 in the DEIS)

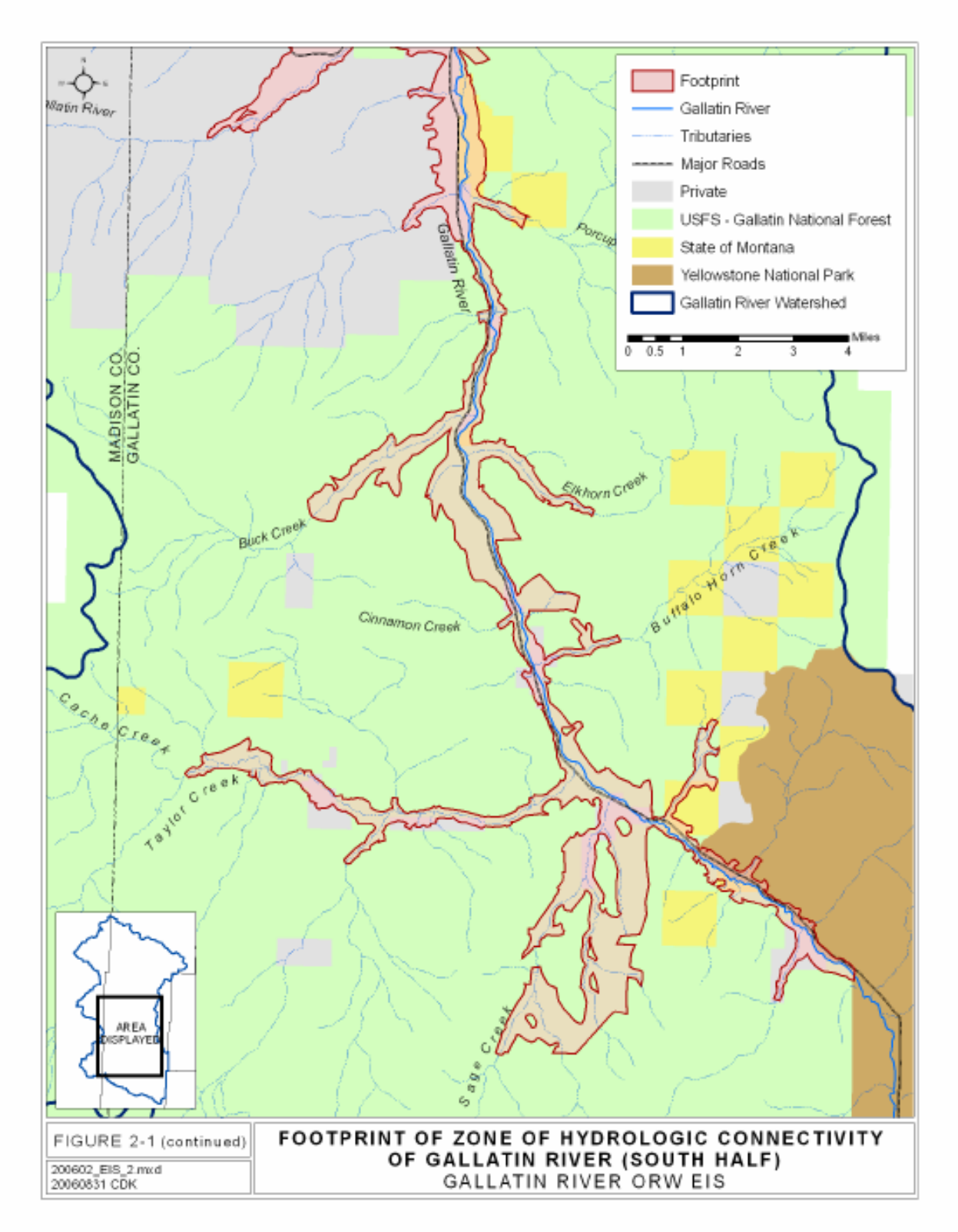

Figure 2.2-1. (Continued).

Responses to Technical Comments: Responses to a series of specific and technical comments made by one commenter are presented.

Comment 9: The commenter did not believe that sufficient evaluations were conducted to support the conclusions and alternatives set forth in the DEIS.

Response: The alternatives and analysis performed for the DEIS did not require extensive data analysis since the assessment of potential impacts to the Gallatin River were based on a standard approach routinely used by DEQ, the nondegradation analysis, which predicts the incremental increase in nitrate (an N) and inorganic phosphorus above current levels. Neither the DEQ nondegradation method, nor the proposed ORW designation requires an analysis of the sources and trends of historical or current levels of contaminants in the river.

Comment 10: The commenter has not detected any statistically significant discernable time trends in nutrient concentration.

Response: A determination of statistical significance or a correlation of potential variables regarding one or more specific water pollutants is not a pre-requisite for the Proposed Action or Alternative Actions.

Comment 11: In reference to DEIS Figure 4.3-6, when all variables are considered, there is no evidence of increasing nutrient concentrations from 2000 to 2004 in the Gallatin River either above or below its confluence with the West Fork. The comment also notes that the figure did not include orthophosphate data, even though inorganic phosphorus is considered the limiting nutrient in the DEIS.

Response: The DEIS (page 144) stated, regarding Figure 4.3-6, that the higher observed nitrate in the West Fork in winter months was, in part, likely due to the lower rates of dilution by surface runoff. Hence winter nitrate concentrations are likely more reflective of groundwater which is in communication with, and tributary to the river, and thus of interest in illustrating this hydrologic connection. The analysis on page 144 further notes that winter nitrate concentrations in the West Fork are as much as three times higher than concurrent concentrations in the Gallatin River mainstem above the confluence with the West Fork. DEQ believes that the available data plotted in Figure 4.3-6 are sufficient to indicate these trends are credible, even though there may be insufficient data to subject to a statistical analysis. The DEIS, on page 198, notes that one sample result in Figure 4.3-6 approached 1.0 mg/L (value 0.8 mg/L), and indicated that nitrate levels in the West Fork appeared to be trending seasonally higher than other measured stations. Overall, DEQ did not base its analysis on the single, highest nitrate data point in Figure 4.3-6 as implied by the commenter. In fact, the elevated winter nitrate concentrations of the West Fork, the most developed drainage in the Gallatin River basin, illustrate that groundwater in the Big Sky area currently contains sufficient nitrate to result in seasonally elevated nitrate levels in surface waters.

The DEIS considered phosphorus the “limiting” nutrient because, given the typical discharge from a domestic wastewater system, it would require fewer SFEs discharging to the Gallatin River to reach the phosphorus limit (0.001 mg/L) as compared to the nitrate limit (0.01 mg/L).

Comment 12: There is no conclusive evidence that nutrient levels are currently an issue on the Gallatin River mainstem on the basis of the Bollman studies.

Response: Neither the DEQ nondegradation method, nor the proposed ORW designation requires an analysis of the sources and trends of historical nor current levels of contaminants in the river. Also refer to Section 2.5.2 of this FEIS for an additional response to this comment.

Comment 13: The commenter requests information, data, citations and methods used to confirm that there is a scientifically supportable "documented trend" toward degradation and /or increase in nutrients that is based on data not inference.

Response: The DEIS did not have the objective of demonstrating a trend of degradation in water quality from nutrients or other pollutants. The ORW designation and other Alternatives are not predicated on correction of a trend of degradation, but rather protection from future point sources of pollutants. Also, see response in this FEIS to comments in Section 2.2.2.2 regarding Water Quality Trends and Background

Comment 14: The TMDL process is the best way to protect the Gallatin River.

Response: The ORW designation protects water quality from measurable change from point sources, including SWTSs, and considers cumulative effects. ORW designation is a process that will assist in preventing the need for TMDL limits in the future. TMDLs protect water quality to the water quality standard, but only come into consideration after water quality degradation has begun. In addition, TMDLs primarily address loads due to nonpoint sources. Refer to Current Policy and Cumulative Impacts, Section 2.2.2.2 above.

Comment 15: Using a footprint to artificially designate and draw a boundary whereby all nutrients either contribute, or do not contribute, is highly subjective and unrealistic.

Response: As described in Appendix F, the DEIS used standard hydrogeologic methods to designate the footprint, including previous similar mapping in the Big Sky area by Baldwin (1996, 1997). The location of the footprint boundary line was often determined by a geologic contact as mapped by the USGS and Montana Bureau of Mines and Geology. Groundwater flow direction, rate of flow and potential hydrologic connection to streams can be quite different across hydrogeologic units. Moreover, the DEIS recognized that site-specific conditions, not the DEIS map of the footprint, would ultimately determine whether a specific source of contaminants was considered to be in direct hydrologic connection to surface waters. See DEIS, pgs. 20 and 140).

As mentioned previously in the FEIS, development of the vulnerability footprint map was necessary to perform the assessment of potential impacts to land use and socioeconomic issues as required in the development of the DEIS. The footprint will not be used as an absolute boundary for review of impacts for future developments. As indicated in the Notice for the Public Hearing, the Board of Environmental Review is proposing to amend ARM 17.30.617 to designate the specific mainstem section of the Gallatin River as an ORW and to amend ARM 17.30.638 (1) to

add a new subsection clarifying that discharges to ground water with a direct hydrologic connection to an ORW fall within the statutory mandate prohibiting any permanent change in the water quality of an ORW resulting from point source discharges. Thus, the Proposed Action is based on "direct hydrologic connection" (as defined in Appendix B) and not on the footprint map as presented in the DEIS. Site-specific data will be used for each proposed development to determine if it is in direct hydrologic connection with the Gallatin River.

The footprint setback is not unlike many other regulatory setbacks that utilize a single line to protect resources and human health. The DEIS could have proposed multiple footprint lines with varying percentages of wastewater discharged within each line assumed to reach the Gallatin, but that would have increased complexity of the footprint. DEQ did not believe that there were sufficient data available to propose a more complex scenario of multiple footprints within the ORW.

Comment 16: The DEIS does not account for nonpoint sources of nutrients and only relies on a measurable change for its threshold.

Response: Neither the DEQ nondegradation method, nor the proposed ORW designation requires an analysis of the sources and trends of historical or current levels of contaminants in the river and are based on the incremental change of the parameter of concern such as nutrients. Also refer to Section 2.1.2 Issues Raised and Responses (FEIS) for nonpoint sources being excluded under ORW designation. Refer also to response to Comment 1.

Comment 17: The footprint map is too subjective to yield meaningful results owing to the myriad of factors described in previous comments.

Response: As stated in Appendix F of the DEIS, the footprint map evaluation was based on a review of the scientific literature, and the methodology developed for the vulnerability assessment was a hybrid of a "subjective rating method" and a "process-based method". The subjective portion utilized three categories of vulnerability (high = 3, medium = 2, and low = 1), as shown in Table F-1 of the DEIS. However, this rating system was based on the results of the process method, shown in Table F-2, which relied on a calculation of groundwater velocity and the one-year time of travel distance within each type of hydrogeologic unit in the footprint map area. Thus, the underlying basis for the vulnerability ratings and the footprint map was objective, and based on the available scientific information.

Comment 18: The DEIS appears to have omitted discussion of one of the key sources contributing nutrients to the West Fork of Gallatin River; historic leakage from the waste-water ponds at Meadow Village and the historic leakage of sewer piping in the watershed.

Response: Neither the DEQ nondegradation method, nor the proposed ORW designation requires an analysis of the sources and trends of historical nor current levels of contaminants in the river. In consideration, the commenter also states that both leakages were remedied by 1998. Although residual nutrients would require some time to dissipate, the footprint map outline includes the area likely to have a groundwater travel time to the streams of one year or less. Thus the current

impact of nutrients from these sources should be mostly dissipated from the mapped footprint area.

Comment 19: Concern is expressed regarding the classification of the Thermopolis Shale unit as "high vulnerability" in Appendix F of the DEIS, and the limitations of the permeability data.

Response: DEQ acknowledges that the permeability and groundwater transport characteristics of the rocks in the Big Sky area can vary from place to place. Thus the Proposed Action to amend ARM 17.30.638 (1) is based on "discharges to ground water with a direct hydrologic connection to an ORW" (which will be based on site-specific data) and not on the vulnerability footprint map as presented in the DEIS.

Comment 20: The commenter states he does not believe that the DEIS provides a realistic assessment of hydraulic conductivity[2] for the connectivity determination for the sedimentary units in the vicinity of Big Sky.

Response: See response to Comment 19 above. DEQ will utilize site-specific hydrogeologic information supplied by permittees to evaluate the potential hydrologic connection to surface waters. As this information accumulates over time, DEQ expects that the available data for assessing hydrologic connectivity will improve. As stated above, the Proposed Action to amend ARM 17.30.638 (1) is based on "discharges to ground water with a direct hydrologic connection to an ORW" (which will be based on site-specific data) and not on the vulnerability footprint map as presented in the DEIS.

Comment 21: It is odd that the hydraulic connectivity assessment for all intents and purposes yields a footprint that stops at or near the Gallatin County-Madison County boundary.

Response: The Gallatin County-Madison County line was not a factor in the footprint map evaluation. It was based on the criteria described in Appendix F of the DEIS. In fact Figure 2-1 of the DEIS (and FEIS) clearly shows that the footprint area extends in to Madison County in the Spanish Creek drainage.

Comment 22. The commenter performed a site-specific evaluation of the footprint area in Township 7S, Range 4E, Sections 5 & 6, and concluded that the hydraulic conductivity conditions assumed to create the footprint do not match the site conditions at this location. He opines that additional "ground truthing" and examination are necessary for the EIS process to be meaningful.

Response: See the general response to, "The Vulnerability Footprint Map" (DEIS Figure 2-1), and response to Comment 15. Mapped terrace gravel deposits were included within the footprint even though they may currently be unsaturated and/or lie above the 40-foot criterion defined in Table F-4 of the DEIS. This method was used because references cited in the DEIS (Morrison Maierle 1997, 2005) showed subsurface information indicating that terrace deposits were in direct contact with alluvium, and that nothing would prevent the migration of wastewater

[2] The extent to which a given substance allows water to flow through it, determined by such factors as sorting and grain size and shape.

through the terrace gravel to the river alluvium once wastewater disposal systems had been discharging. The commenter further describes site specific geologic interpretations including a deep well which he says indicates that significant water was not found until a depth of about 1,219-feet below ground surface. As indicated in the other responses referenced above, DEQ will consider site-specific information in the application of the proposed amendment to ARM 17.30.638 (1), which is based on "discharges to ground water with a direct hydrologic connection to an ORW", and not on the vulnerability footprint map as presented in the DEIS.

To further clarify footprint delineation in regard to mapped alluvium and gravel terrace deposits, an updated memo is provided in Appendix B, explaining in detail the delineation methods. This memo is slightly revised from its appearance in the DEIS, where it was Appendix F. The specific edits and changes to this memo since the DEIS are:

- Page 1, first paragraph - edits to update the background information
- Page 4, 4th bullet- added b)
- Page 5, first full paragraph – this addition is new and clarifies the exception, and
- Table 1. Third line from the end. Corrected 3-Lowest vulnerability to 1- Lowest vulnerability.

No changes to the footprint map were needed due to these revisions.

Comment 23: The recent decision by the Montana Supreme Court opined that all groundwater is directly connected to surface water and questions if this decision will have any impact on the ORW now or in the future.

Response: DEQ believes the commenter is referring to a recent water law ruling by the Montana Supreme Court. As the Proposed Action and Alternatives dealt strictly with water quality, DEQ does not believe there is a direct implication of this ruling for the ORW, since Montana water rights laws and water quality laws are distinct and separately administered. The criteria used to define what sites are in "direct hydrologic connection" are provided in detail in Appendix B of this FEIS.

Single Family Equivalents Determination:

Comment 24: Several commenters found the use of 'SFEs' confusing, or questioned why seasonal occupancy of residences in Big Sky was not taken into account in analyses in the DEIS.

Response: The use of SFEs is a standard method in the evaluating water quality impacts as a result of subsurface wastewater treatment systems (SWTS), which typically consist of a septic tank and drainfield (DEQ 2005). It is a baseline for effluent characteristics, or water quality and quantity of wastewater for both SWTSs as well as sewered connections. For this analysis, one SFE, or dwelling unit, was considered to be a single family residence having two bedrooms and two bathrooms.

Wastewater effluent characteristics have been studied and quantified based on SFEs. Using known characteristics of a typical household or SFE, and dividing by the trigger value, which is the measurable change for inorganic phosphorus as indicated in the DEQ-7 circular (DEQ

2006b), the number of typical households or SFEs which meet the trigger value can be determined. Refer to Appendix A of the DEIS for more complete discussion. In the case of the Gallatin River ORW EIS, the inorganic phosphorus trigger value was found to be more sensitive than the nitrate trigger value.

The trigger value is basically the smallest measurable change that can be practically quantified using laboratory analytical methods. These values are presented in DEQ-7 circular for numerous parameters, including nitrate (as N) and inorganic phosphorus (DEQ 2006b). This concentration, in the case of inorganic phosphorus, is 0.001 mg/L. To calculate how much inorganic phosphorus it would take to increase the concentration of the water by the trigger value, the quantity of water must be known.

The quantity or in this case, the 7Q10, is the 7-day consecutive, 10-year low flow for the Gallatin River stream gauging station near Gallatin Gateway. This quantity is based on a specific statistical analysis of historical flow. This standard low flow quantity is used by DEQ as the streamflow rate with which pollutant mixing and compliance are calculated for many water quality parameters, including inorganic phosphorus (ARM 17.30.516).

The inorganic phosphorus limit for the ORW designation is based on the Gallatin Gateway USGS gauging station 7Q10 for the Gallatin River of 204 cubic feet per second (USGS 2005). With this quantity of water, and a trigger value concentration of 0.001 mg/L of inorganic phosphorus, it would take approximately 401 lbs of inorganic phosphorus per year to raise the concentration in the Gallatin River to 0.001 mg/L inorganic phosphorus at the 7Q10 low flow conditions, as calculated by the DEQ dilution equation (Appendix A, DEIS).

The DEIS analysis adjusted the SFE wastewater flow to account for part-time occupancy, from the standard 200 gallons per day for each SFE, to 153 gallons per day. This adjustment was based on average flows measured at the Big Sky Water and Sewer District wastewater treatment system, which necessarily accounts for the seasonal use of many residences in the Big Sky area (Nicklin, 2000a). Therefore, the 401 lbs of P divided by 4.93 lbs P for each SFE would result in approximately 81 SFE to meet the trigger value concentration for inorganic phosphorus.

The 81 SFEs are reduced by 14 SFE for the allocation for conservation easements and development of state lands, giving 67 SFEs as referenced in the DEIS document (Section 4.3.2 DEIS).

2.2.2.4 Extent of the ORW

Comment 25: Several commenters stated they thought the area under consideration for ORW designation should be expanded, especially to go downstream to the confluence with the Missouri River.

Response: DEQ does not have the authority to change the extent of the ORW designation. The ORW reach is defined by the initial petition. (Section 1.9 DEIS)

2.2.2.5 Mitigation Measures

Advanced Treatment Options:

Comment 26: Several commenters questioned whether full build-out could really be achieved with the mitigation actions proposed in the DEIS. They referred to the mitigation actions for the Proposed Action Alternative.

Response: Some of the advanced treatment options could be used together in series in order to achieve higher nutrient removal than each individual treatment option alone. One such scenario would use a hybrid system incorporating the use of Option C, composting or incinerator toilets, to treat the black water from the toilets which results in zero discharge of the black water. This treatment would reduce the overall inorganic phosphorus by 59% by removing the black water. The remaining gray water (discharge from sources other than toilets, such as bath tubs) would be discharged through a chemical removal system (Option B) which would further reduce the inorganic phosphorus by 50%. Refer to Figure 2.2-2 (Revised version of Figure 4.3-9 in the DEIS), Predicted Phosphorus Concentrations to the Gallatin River above Background for Selected SWTSs. This revised graph shows the addition of the hybrid Option B+C (combined chemical treatment and composting/incinerator toilets) scenario outlined above.

The zero discharge mitigation measure of on-site storage of septage in sealed vaults is not legal in Montana. Although this treatment option would result in zero discharge, a change in the law to allow sealed vaults would have to be made. Another zero discharge hybrid option would use Option C for the treating the black water (discharge from toilets) and diverting the gray water to the storage vault for off site disposal, and the result would be a zero discharge system. This type of storage vault system is also not currently allowed. However, MEPA allows analyses to include methods which are feasible, but outside of DEQ's jurisdiction to implement.

Pollutant Trading:

Comment 27: One commenter asked whether pollutant trading will be allowed to help stay within the nutrient limits.

Response: EPA believes pollutant trading is appropriate for certain pollutants (including nutrients), and some states have policies to allow it. DEQ does not have a policy or applicable regulations to allow pollutant trading at this time. Although pollutant trading is not available as a mitigation measure under current regulation, it is something that could be made available with a change in law or rules.

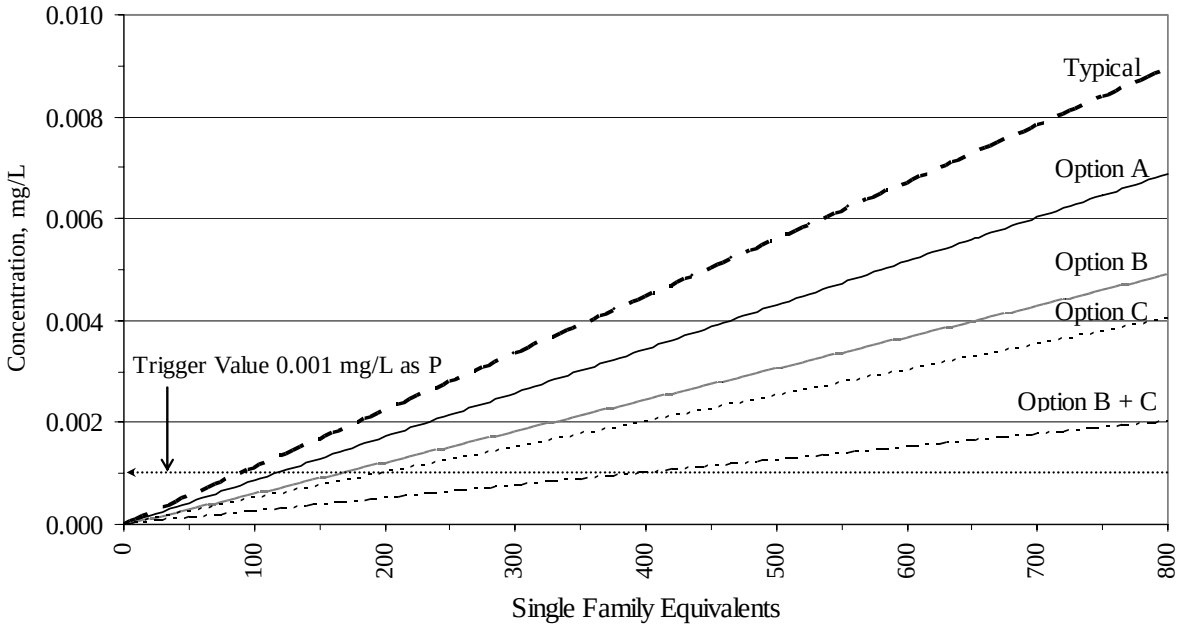

Figure 2.2-2 (Revised version of Figure 4.3-9 in the DEIS). Predicted phosphorus (as P) concentration resulting from typical septic treatment, and four mitigation options (see Table 2.3-1). Concentrations are shown in relation to water quality standards trigger value of 0.001 mg/L in the mainstem of the Gallatin River. Plotted concentrations are based on calculated phosphorus loading and dilution based on 7Q10 flows as measure at USGS Station 06043500, near Gallatin Gateway, Montana.

2.2.2.6 Existing Regulation of Hydrologically Connected Groundwater

Comment 28: Several commenters mistakenly asserted that the concept of hydrologic connection is new to nondegradation reviews.

Response: Section 2.2.1, page 16 of the DEIS addresses this issue: "In accordance with ARM 17.36.312, subdivisions located adjacent to state surface waters require an analysis of the effects of the proposed sewage treatment systems on the quality of the nearest down-gradient high quality state surface water" (DEQ 2005). DEQ's subdivision nondegradation guidance document defines proximity to surface waters as a direct hydrologic connection to the water in question (DEQ 2005). Determining whether a discharge is in direct hydrologic connection to the surface water is site-specific and depends on geology, hydrogeology, volume of the discharge, sensitivity of the surface water, and other site properties (DEQ 2005). "For septic systems, DEQ's nondegradation review first assesses surface water impacts in relation to the state's trigger values (DEQ 2006b). Trigger values are used to determine if a given increase in the concentration of a toxic or nutrient parameter is "significant degradation" or "non-significant degradation" under the nondegradation rules (DEQ 2006b, ARM 17.30.715(1)(c)). If the proposed development stays below the trigger level for nutrients (nitrogen and phosphorus [nitrate (as N) and inorganic phosphorus]), it is considered to be in compliance with the nondegradation policy. If the development exceeds the trigger values for nitrogen and phosphorus [nitrate (as N) and inorganic phosphorus], the proponent can evaluate the surface water impacts via the narrative standard (DEQ 2005a; ARM 17.30.715(1)(g)). If the discharge of [inorganic] phosphorus can meet the

50-year breakthrough requirement (ARM 17.30.715(1)(e)), then the trigger level analysis is not required for [inorganic] phosphorus for subdivisions adjacent to state surface waters. DEQ has had sites fail the trigger value calculation, but then pass a nondegradation review by meeting the narrative standard through surface water modeling (E. Regensburger pers. comm. 2005). Under the No Action Alternative, permittees could continue to use this process to gain approval. Each trigger value analysis is independent of previous and subsequent reviews; therefore, the additive impact of several projects could exceed the trigger value, despite individual projects "passing" the trigger level criteria."

The Footprint will Invite Additional Disputes over Nondegradation Reviews

Comment 29: Several comments asserted that because the footprint of hydrologic connection ("footprint") is used in the DEIS as a guideline (rather than as a definitive boundary), that it will create a situation where the consultants hired by the applicant will be spending an inordinate amount of time arguing with DEQ hydrogeologists over whether a specific proposed subdivision is inside or outside of the footprint using the criteria in Appendix F of the DEIS.

Response: The footprint is defined in the DEIS using the following information related to the geology and hydrogeology of the site: distance from surface water; aquifer hydraulic conductivity; aquifer hydraulic gradient; depth to ground water; aquifer porosity; geologic formation; and confining conditions. Several of these parameters must already be determined by the applicant's consultant and agreed upon by DEQ in reviewing all subdivisions in the state for compliance with nondegradation rules. Distance from surface, aquifer hydraulic conductivity, aquifer hydraulic gradient, and confining conditions are already determined as part of the ground water mixing zone application. The remaining parameters are porosity, depth to ground water and geologic formation. Measurement of true field porosity is difficult, so it is commonly estimated from existing published information (as was done in the DEIS). Depth to ground water is easily determined through measurements in ground water wells. The geologic formation is easily determined through existing geologic maps or existing well logs.

Therefore, the amount of extra information that will be needed to be submitted by the applicant and approved by DEQ to define whether a specific site is within the footprint is minimal. In addition, the concept that ORW designation will initiate a new review process involving "dueling hydrogeologists" is incorrect. The process where applicants submit information for DEQ to review and comment on has existed since the nondegradation rules went into effect in 1994.

2.3 Land Use and Recreation

Several comments were received by DEQ regarding DEIS analysis of ORW impact to land use; only one, very general comment was received related to recreation use. The comments mostly focused on impacts to development potential on private lands. Other comments mentioned concerns about potential impacts to agriculture, logging and mining. Some comments supported the proposed ORW designation, noting that it is consistent with management of the Gallatin National Forest in the broader watershed and is a needed step in protecting environmental and recreation values along the ORW reach, and thus helping to protect the economy of the area.

2.3.1 Comment Summary

Comments regarding ORW impacts to land use on private lands focused largely on development potential on private lands and voiced the following concerns:

2.3.1.1 Area of ORW Impact on Land Use

Several comments reflect a belief that the area of land that would be subject to ORW restrictions would (or could) be significantly larger than that delineated within the footprint, potentially including such areas as Yellowstone Club, Spanish Peaks and Moonlight Ranch. One commenter further asserts that, due to this uncertainty, it is not feasible to (and the DEIS does not) accurately assess the extent of land use impacts. Related to this concern, other comments included requests for: 1) confirmation that land use outside of the footprint would not be restricted in any manner; 2) mapping showing more specifically which undeveloped and partially developed lands (by zoning classification) are encompassed by the footprint, and 3) a determination by DEQ of whether specific parcels are inside or outside of the footprint.

2.3.1.2 Context of DEIS Impact Analysis

One comment suggested that possible restrictions on development within the ORW footprint be reported in context of full build-out potential on all private land in Gallatin County. The suggestion was made that possible impacts/restrictions on build-out potential within the footprint may represent only a minor percentage of full build-out countywide. Related to this view, another comment requested a review of the build-out potential within the Big Sky Water and Sewer District (which would not be affected by the ORW designation), and comparison of this build-out potential with possible reductions in build-out potential within the ORW footprint.

2.3.1.3 Method and Assumptions used to Specify Allowable Development within the Footprint under the Proposed Action

Some comments requested additional explanation of how the build-out potential (expressed in dwelling units or square feet of commercial, industrial, recreational, and community facilities uses) was calculated for the alternatives.

One commenter stated that the following assumptions used in the DEIS are not valid and are overly restrictive: 1) the pollutants from on-site wastewater discharge systems (e.g. septic tank leach fields) would reach the river without any natural attenuation; and 2) dwelling units would be occupied year-round. The commenter indicated that natural attenuation would occur and should be taken into account and that many, if not most, dwelling units in the study area are only occupied seasonally.

2.3.1.4 Potential for Mitigation

The assertion in the DEIS that ORW impacts on land use and development potential can be fully mitigated by using zero-discharge or centralized treatment systems was questioned. Comments were made that zero-discharge systems are either not allowable or not truly practical in the area, and that affected lands are generally either not large enough or are zoned for too low density to make centralized treatment a viable option. In the latter regard, a commenter suggested that some potentially impacted lands near the existing boundary of the Big Sky Water and Sewer District could be incorporated into the District's system as a means of achieving full mitigation.

Another concern of commenters was that the most effective "advanced on-site treatment" options (e.g. incinerator and composting toilets) are either impractical in the study area or would not be as effective as indicated in the DEIS, thus yielding even less development potential than indicated on DEIS Tables 4.4-6 and 4.4-7.

2.3.1.5 Actual Impact of the ORW Designation

Several comments reflect the belief that the ORW designation will "shut down" building and development within the footprint, and that the land will become "unusable and worthless", with development rights essentially confiscated. The concern is also expressed by commenters that existing developments could be shut down.

2.3.1.6 Impact on the Big Sky Community Plan

Under the perception noted above (i.e. severe restrictions on further development within the footprint), the point is raised that the ORW designation would undermine the plan for a viable community in Big Sky, eliminating any future commercial and light industrial development and placing increased stress (e.g. truck traffic) on Hwy 191.

2.3.1.7 Grandfathering of Existing On-site Wastewater Systems within the Footprint

The DEIS notes that only new on-site wastewater systems would be subject to ORW regulations; existing systems would not be impacted. Another commenter suggested that all private parcels within the footprint should be grandfathered according to "development right" established by existing zoning.

2.3.1.8 Impacts to Public Lands

Comments related to public lands use within the ORW study area suggested that:

- The ORW designation will impact the ability of federal agencies to expand services.
- Activities such as agriculture and timber harvesting are nonpoint sources, and would thus not be subject to ORW-related regulation.
- Mining activity remains legal and possible. The DEIS should address this potential, including potential restrictions on sand and gravel mining or other mining activities that would need a discharge permit (whether inside or outside of the footprint).
- The USDA Forest Service indicates that an ORW designation "could be very compatible with Gallatin National Forest management of the Gallatin River watershed and river corridor" and that the Forest Service has no objections to and supports the designation. The Forest Service also suggests that additional information regarding the Forest's land

exchange, fuel treatment, timber harvest, mining and livestock grazing programs would be useful as part of the EIS.

2.3.1.9 Comments in Support of the Proposed ORW Designation

Two comments expressed support for the ORW designation whether or not it would reduce build-out potential or increase cost of development within the footprint. Points made by these commenters include:

- The river should be protected with this designation because history has shown that current regulations do not adequately protect water quality in the face of development, and this river corridor is a legacy worth saving.
- Protection of the river is important to the thousands of visitors who come for fishing, birding, and other enjoyment of a high quality environment. In this regards, river protection also protects revenue.

2.3.2 Issues Raised and Responses

Analysis of, and response to, comments on land use and recreation are provided below according to the same headings and order used above to organize and summarize the comments:

2.3.2.1 Area of ORW Impact on Land Use

Comment 30: The ORW footprint boundary is too uncertain to permit an accurate or reasonable analysis of land use impact; areas far larger than those encompassed by the footprint shown in the DEIS could be impacted by the ORW designation.

Response: The ORW footprint shown in the DEIS is the best available approximation of the area that would be affected by proposed ORW regulation. As discussed earlier in the water quality section of this FEIS, this footprint generally illustrates those lands along the ORW reach that have a direct hydrologic connection to the river. It is not an exact boundary, but it is based on the best available information. While an approximation, the footprint is sufficiently well defined to permit a reasonable analysis of potential impacts to land use and development. Further, the footprint is sufficiently well defined to support the assertion on which DEIS analysis is based—that the area of potential impact (i.e. area subject to ORW regulation) will not be significantly larger than shown by the footprint.

Comment 31: The DEIS should include more detailed mapping showing which lands (by zoning classification) and which specific parcels are within the footprint.

Response: The footprint boundary shown in the DEIS is sufficiently well defined to support generalized analysis of impact in the DEIS, but it is not sufficiently defined to allow parcel-by-parcel determinations. For this reason, mapping of land use and parcelization specifically related to the footprint is not provided in the DEIS. Providing such mapping would infer more accuracy in the footprint boundary than is actually the case.

In implementing ORW regulation, if adopted, DEQ will review and define the “direct hydrologic connection” boundary on a case-by-case basis as development permit applications are submitted and more detailed, site-specific hydrogeologic information is made available. This general approach is standard procedure for DEQ.

2.3.2.2 Context of DEIS Impact Analysis

Comment 32: Possible restrictions on development within the ORW footprint should be reported in context of full build-out potential on all private land in Gallatin County. Impacts or restrictions on build-out potential within the footprint may represent only a minor percentage of full build-out countywide.

Response: Early in the MEPA scoping process, the decision was made to focus analysis on the land area potentially impacted by the proposed ORW designation, and to not attempt collecting and analyzing land use data for all of Big Sky or Gallatin County as a whole. Thus, the DEIS does not compare potential build-out in the ORW footprint (under any alternative) with build-out in these larger areas. This approach (scope) for the DEIS is considered appropriate under MEPA both to focus attention specifically and clearly on the potentially impacted area, and for cost and time efficiency purposes. While a review of the relative proportion of Big Sky or Gallatin County build-out potential the footprint represents would be informative, it is not necessary to a direct understanding of ORW impacts.

Comment 33: The DEIS should provide a review of the build-out potential within the Big Sky Water and Sewer District (which would not be affected by the ORW designation), and compare this with possible reductions in build-out potential within the ORW footprint.

Response: The Big Sky Water and Sewer District is largely built-out. The acreage of undeveloped and partially developed land within the District is small compared with that in the ORW footprint outside of the District.

2.3.2.3 Method and Assumptions used to Specify Allowable Development within the Footprint under the Proposed Action

Comment 34: The DEIS should provide additional explanation of how the build-out potential (expressed in dwelling units or square feet of commercial, industrial, recreational, and community facilities uses) was calculated for the alternatives.

Response: Appendix H of the DEIS explains the method used to identify undeveloped and partially developed land (acreage) within the ORW footprint. Section 4.4.3.1 and Tables 4.4-2 and 4.4-5 of the DEIS explain the method used to determine allowable development on these lands under the proposed ORW designation without mitigation (i.e. most limited development analysis).

In short, water quality analysis determined that ceilings on allowable additional inorganic phosphorus and nitrate (as N) loading under an ORW designation would mean that there could be no more than 1 SFE per 27.6 acres of the remaining undeveloped/partially developed land in the footprint. For the purposes of analysis, one SFE was considered equal to one dwelling unit (see page 161, paragraph 3 of the DEIS for further explanation). Translations of this 1 SFE(DU)/27.6 acre allocation into square feet equivalent for commercial and industrial parcels are explained in footnotes b and c of Table 4.4-4 in the DEIS. These units were used in calculations to assess impacts, but are not proposed as a framework for implementation.

Calculations of allowable development under the various mitigation conditions discussed for the ORW Alternative simply accounted for the percentage of pollutants removed by the mitigation options (versus the unmitigated condition), thereby showing the additional development that

would be allowable using these advanced or alternative treatment options. For example, the chemical removal system option would reduce key pollutant loads by 50%, resulting in double the amount of allowable development when compared with the unmitigated condition.

Comment 35: The DEIS assumption that the pollutants from on-site wastewater discharge systems (e.g. septic tank leach fields) would reach the river without any natural attenuation is not valid and is overly restrictive.

Response: See also response to Comment 6. The DEIS used a most restrictive case approach in order to portray maximum potential for impact. This approach is the best available under the circumstances, as it avoids underestimating impacts. There may be natural attenuation of pollutant loads between the subsurface discharge point and the river; however, the degree of attenuation would be subject to many variables and would likely vary significantly from one area or parcel to another. It would be too speculative to attempt to define an "average" attenuation factor for the entire ORW footprint. If the Proposed Action Alternative is adopted, any applicant who wishes to demonstrate site-specific attenuation rates in calculating pollutant loading rates to the groundwater and surface water may submit that information to DEQ. DEQ will review and determine the applicability of proposed attenuation rates.

Comment 36: The apparent DEIS assumption that dwelling units would be occupied year-round is not valid and is overly restrictive. A high proportion of dwelling units in this area are only seasonally occupied

Response: The nutrient loading does take into account that most residences are occupied seasonally by reducing the gallons per day used for the dilution equation from 200 to 153 gallons per day (See Section 2.2.2.3, Single Family Equivalent Determinations, FEIS, and Section 4.3.1 of the DEIS)

2.3.2.4 Potential for Mitigation

Comment 37: The potential effectiveness and feasibility of mitigation shown in the DEIS is questionable. The most effective "advanced on-site treatment" options (e.g. incinerator and composting toilets) are either impractical in the study area or would not be as effective as indicated in the DEIS; zero-discharge systems are either not allowable or not truly practical in the area; and affected lands in the footprint are generally either not large enough or are zoned for too low density to make centralized treatment a viable option. Development potential in the footprint would actually be less than shown on DEIS Tables 4.4-6 and 4.4-7, and full mitigation is likely not feasible.

Response: Research prior to the DEIS on the practicality and effectiveness of advanced on-site treatment options (i.e. re-circulating sand filter, chemical removal, and composting or incinerator toilets) confirms that these options are available and feasible for use in the ORW study area and would achieve the level of mitigation shown in the DEIS (Tables 4.4-7 and 4.4-7).

It is also feasible to use the chemical removal and composting/incinerator toilet options in combination, resulting in another increment of mitigation under the category of advanced on-site treatment. Mitigation achievable using this option is shown on the revised Tables 4.4-6 and 4.4-7 shown below. See also Section 2.2.2.5 FEIS)

The zero discharge option is technically feasible and may be applicable to many areas in the ORW footprint. This option, because of its reliance on sealed storage vaults, is not allowed in

Montana under current regulations; a change in the law would be needed to permit the use of such vaults.

Centralized treatment systems are probably not practical for much of the undeveloped and partially developed land in the ORW footprint. Most of these lands have one or more of the following characteristics: 1) zoned for low density (e.g. multiple-acre lots); 2) relatively small parcel/contiguous area size; or 3) dispersed over large, discontinuous areas, often with intervening developed lands or such features as US Highway 191 or the river. It is not within the scope of this EIS analysis to determine with certainty if and where centralized treatment systems may be technically feasible and economically viable. However, it is likely that technical feasibility is less of a constraint in some areas; whereas economic viability is questionable over much of the study area.

Table 2.3-1. (Revised version of Table 4.4-6 in the DEIS.) Allowable residential development (all numbers are in dwelling units [DU]) within the footprint using alternative wastewater treatment systems: Proposed Action, with and without mitigation.

Land Use Classification	No Mitigation	Advanced On-Site Treatment Mitigation Options				Zero-Discharge and/or Centralized Treatment Mitigation Options
		A. Re-circulating sand filter	B. Chemical removal	C. Composting/ incinerator toilet	B+C. Chemical removal & composting or incinerator toilet	
Gallatin Canyon/Big Sky Zoning District						
Residential						
Single Family 7500	1	1	2	3	6	226
Single Family 11000	1	1	2	3	6	67
Residential Cluster 1 DU/acre	2	3	4	5	12	60
Residential Cluster 1 DU/2.5 acres	7	10	14	19	41	72
Residential Cluster 1 DU/5 acres	12	17	24	32	71	66
Residential Cluster 1 DU/10 acres	7	10	14	19	41	15
Residential Cluster 1 DU/20 acres	7	10	14	19	41	10
Subtotal	**37**	**52**	**74**	**100**	**219**	**516**
Percent change from full build-out:	**-93%**	**-90%**	**-86%**	**-81%**	**-58%**	**0%**
South Gallatin Zoning District						
Canyon Residential 1 DU/3 acres	5	7	10	14	31	48
Recreation and Forestry 1 DU/50 acres	15	21	30	40	88	8
Subtotal	**20**	**28**	**40**	**54**	**118**	**56**
Percent change from full build-out:	**-64%**	**-50%**	**-29%**	**-3%**	**111%**	**0%**
Spanish Creek-Karst Area						
Rural Areas (not zoned)	8	11	15	21	45	70
Conservation Easements (not zoned)	10	14	20	27	59	10
Subtotal	**18**	**25**	**35**	**48**	**104**	**80**
Percent change from full build-out:	**-78%**	**-69%**	**-56%**	**-41%**	**30%**	**0%**
Total DU	**75**	**105**	**149**	**202**	**441**	**652**
Percent change from full build-out:	**-89%**	**-84%**	**-77%**	**-69%**	**-32%**	**0%**

Table 2.3-2. (Revised version of Table 4.4-7 in the DEIS.) Allowable commercial development (all numbers are in single family equivalents [SFE]) within the footprint using alternative wastewater treatment systems: Proposed Action, with and without mitigation.

Land Use Classification	No Mitigation	Advanced On-Site Treatment Mitigation Options				Zero-discharge and/or centralized treatment mitigation options
		A. Re-circulating sand filter	B. Chemical removal	C. Composting/ incinerator toilet	B+C. Chemical removal & composting or incinerator toilet	
Gallatin Canyon/Big Sky Zoning District						
Community Commercial	374	534	748	1,011	2,211	91,000
Commercial & Industrial Mixed Use	1,980	2,829	3,960	5,351	11,707	270,000
Recreational Business	218	311	436	589	1,289	45,000
Community Facilities	73	104	146	197	432	13,000
Total	**2,645**	**3,778**	**5,290**	**7,148**	**15,639**	**419,000**
Percent reduction from full build-out:	**-99%**	**-99%**	**-99%**	**-98%**	**-96%**	**0%**

These findings suggest that the "best case" mitigation condition will be between (see Tables 2.3-1 and 2.3-2): 1) the level of development allowed under the combined chemical treatment and composting/incinerator toilet advanced on-site treatment option (i.e. overall reductions of 32% in allowable residential and 96% in allowable commercial/industrial uses compared with the No Action/full build-out Alternative), and 2) the 100% mitigation shown for zero-discharge or centralized treatment and disposal outside of the footprint. The second option has the potential to allow full build-out of the 652 dwelling units within the footprint. However, given the constraints on and questions about the zero-charge or centralized treatment options, the impact of the Proposed Action Alternative would likely be closer to the former condition.

2.3.2.5 Actual Impact of the ORW Designation

Comment 38: The ORW designation will shut down building and development within the footprint, and development rights will be essentially confiscated. Existing developments could also be shut down.

Response: Overall, the discussion in Section 2.3.2.4 suggests that the ORW designation could have significant impacts on development potential within the footprint if zero-discharge and/or centralized treatment systems are found not to be feasible on a case-by-case basis. In the absence of such "full mitigation" options, the impact would not represent a "shut down" of residential development, but would approach this description for commercial, industrial, and community facilities uses. However, the proposed ORW designation would not impact existing developments.

While acreage was used in the DEIS as a tool to predict the impacts on development of ORW designation, DEQ cannot issue permits on that basis. Permitting would essentially be first come, first served, as with the Cumulative Impacts Analysis Alternative. Unlike the Cumulative Impacts Analysis Alternative, ORW designation would prevent DEQ from permitting new or increased point source discharges to the Gallatin River and from authorizing degradation of water quality in the river. The effects on development would likely be similar to those indicated in the DEIS.

2.3.2.6 Impact on the Big Sky Community Plan

Comment 39: The ORW designation would undermine the plan for a viable community in Big Sky, eliminating any future commercial and light industrial development and placing increased stress (e.g. truck traffic) on Hwy 191.

Response: The question of impact to the Big Sky Community Plan centers mostly on whether land use restrictions created by the ORW designation would create imbalances in the community by reducing or eliminating the opportunity for one or more necessary/desirable land uses (e.g. eliminating further expansion of commercial or light industrial use, as cited in the comments on the DEIS). For one specific land use, this kind of impact could occur with the ORW designation. All land in Big Sky that is zoned for Commercial and Industrial Mixed Use is along Highway 191 within the ORW footprint. If zero-discharge or centralized treatment systems are found not to be viable for the 18 acres of remaining undeveloped land in this zoning classification, the ORW would essentially stop further development of this land use unless/until alternative lands could be re-zoned to accommodate this use. For other commercial or community land uses represented in the ORW footprint, acreage is generally small and other options for these uses exist within the Community Plan area. Regarding residential uses, while some level of restriction

on development in the footprint may occur, as discussed above, such restrictions would not likely severely upset the balance of uses crafted in the Community Plan.

2.3.2.7 Grandfathering of Existing On-site Wastewater Systems within the Footprint

Comment 40: All private parcels within the footprint should be grandfathered according to "development right" established by existing zoning.

Response: Existing, permitted on-site wastewater systems would not be impacted by the ORW designation. This "grandfathering" is true for both permitted and constructed systems, and for systems that have received permits but have not been built. However, the comment that all parcels in the ORW footprint should be "grandfathered" according to their zoned "development right" cannot be considered under the ORW Alternative for reasons discussed throughout the DEIS; this option is *de facto* part of the No Action Alternative.

2.3.2.8 Impacts to Public Lands

Comment 41: The ORW designation will impact the ability of federal agencies to expand services.

Response: The USDA Forest Service is the agency responsible for federal public lands in the ORW study area. The Forest Service indicates that an ORW designation "could be very compatible with Gallatin National Forest management of the Gallatin River watershed and river corridor" and that the Forest Service has no objections to and supports the designations.

Comment 42: Agriculture and timber harvesting are nonpoint sources and would not be subject to regulation under the ORW designation.

Response: The comment is accurate and is noted.

Comment 43: Mining activity remains legal and possible. The DEIS should address this potential, including potential restrictions on sand and gravel mining or other mining activities that would need a discharge permit (whether inside or outside of the footprint).

Response: The comment that mining activity is still possible in the ORW study area is valid. Under all of the DEIS alternatives, any future proposal for mining activity in the watershed, whether "hard rock", construction aggregate (sand and gravel), or other mineral would need to obtain an MPDES permit as described in Chapter 2 of the DEIS, for any direct discharge to the ORW reach of the Gallatin River. Under the Proposed Action Alternative, a requirement of the MPDES permit would be that the proposed discharge not result in a permanent change in water quality in the ORW reach of the Gallatin River.

Regarding the comment that there must be some existing examples of sand and gravel operations in the ORW study area (i.e. not recognized by the DEIS); there are, in fact, two sand and gravel extraction operations in the ORW footprint. They are both located in Big Sky, immediately west of Highway 191 and south of Highway 64. These operations would not, however, be impacted by the Proposed Action. Since their MPDES discharge permits were obtained prior to the effective date of the ORW designation, they would operate as part of the baseline condition, similar to existing on-site wastewater treatment systems.

Comment 44: Additional information regarding the Forest's land exchange, fuel treatment, timber harvest, mining and livestock grazing programs would be useful as part of the EIS.

Response: Relevant perspectives on these programs in the Gallatin National Forest surrounding the proposed ORW reach are provided in the DEIS. As noted in the Forest Service comments, these programs are consistent with and would not be directly regulated by the ORW designation. Additional information on any of these programs can be obtained by reviewing the Forest Service sources listed in Chapter 6 of the DEIS.

2.3.2.9 Comments in Support of the Proposed ORW Designation

Comment 45: The river should be protected with the ORW designation because history has shown that current regulations do not adequately protect water quality in the face of development, and this river corridor is a legacy worth saving.

Response: Comment noted.

Comment 46: Protection of the river is important to the thousands of visitors who come for fishing, birding, and other enjoyment of a high quality environment. In this regards, river protection also protects revenue.

Response: Comment noted.

2.4 Socioeconomics

The bulk of the comments recorded at the October 25, 2006 public hearing and at least twenty-seven additional comments received by DEQ were on issues regarding the socioeconomic analysis in the DEIS. The comments generally fell into the following areas: a) need for more recent figures on housing prices and construction employment; b) the large cost of forgone development with the Proposed Action of ORW designation without any mitigating measures; c) the relatively low percentage cost increase in a house with the Proposed Action of ORW with implementation of mitigating measures such as advanced waste treatment; and d) estimates of the benefits of ORW to river recreation, fishing and property values.

2.4.1 Comment Summary

A few comments were received on the need for reliance on more recent data for house prices and construction employment numbers. The commenters indicated that house prices have increased considerably in the last few years. They also noted their opinion that employment in the construction industry in Big Sky had to be much larger than reported in the DEIS due to all the activity in the area. Several commenters recommended obtaining a forthcoming study by the Montana Department of Commerce on the economic impact of Big Sky. Initial reports regarding that study put total jobs for all Big Sky economic activity at 10,000 jobs, far in excess of employment related to Big Sky reported in the DEIS. Some of these commenters indicated that the 300,000 plus skier days in Big Sky contributed far more economic activity to the region than did the fishing and rafting in the Gallatin River. Several commenters indicated that while water quality in the Gallatin River would have an effect on house prices, that house prices were more affected by the ski industry than water quality or fishing.

Several commenters raised issues about the potential for forgone development with the Proposed Action without any mitigating measures such as advanced treatment. These commenters suggested there would be many millions of dollars in economic losses in the form of lost property values on undeveloped lots and losses to the construction industry. They felt the DEIS underestimated these costs, in part, due to old data on the median prices of residential housing in the Big Sky area.

2.4.2 Issues Raised and Responses

2.4.2.1 Extent of Socioeconomic Analyses

Comment 47: It is invalid to confine analysis of economic impacts of ORW designation to just fishing, as that recreation segment is dwarfed by other recreation in the area. Big Sky reported 300,000 skier days that with a cost per lift ticket of $65, and $100 daily incidentals (food, lodging) is worth $49.5 million.

Response: There is no doubt that economic activity generated by skiing at Big Sky is a major visitor use and economic contributor to the Big Sky, West Yellowstone and Gallatin economies. For completeness, this contribution should have been mentioned in the DEIS. However, as noted in the following insertion of new text, the economic effects associated with skiing are not expected to change with any of the alternatives analyzed in the DEIS, and therefore skiing was not deemed a relevant topic for detailed analysis.

Nonetheless, the following has been added to Section 3.5.3.5 Overview of Components of On-Site Recreation Use Values of the DEIS, pages 89 to 90:

> The Gallatin River, and its associated water quality, fisheries, and recreation opportunities, provides several types of economic values to society. This section defines and estimates these values, and how the estimated values pertain to the present water quality of the Gallatin River. By defining and estimating the values of the Gallatin River and its present water quality, a benchmark is established by which to compare potential effects of each alternative.
>
> *While skiing is a major economic activity in the Big Sky area, there is no reason to expect that a skier's decision of whether to visit Big Sky for skiing would be influenced by whether the Gallatin River is designated as an ORW or not. Therefore, the current level of skier days, and skiing-related level of development, is expected to continue at least at the current level with any of the alternatives analyzed. The social and economic analysis focuses on the river-related recreation use that is most likely affected (directly or indirectly) by ORW designation, or by deterioration in water quality.*

Comment 48: One commenter stated that they presumed that conducting an original hedonic property study would be cost-prohibitive, which is why it was not done in the DEIS. However, they questioned any reliance on studies which were very different to quantify the impact from ORW designation on the Gallatin River.

Response: The commenter is correct that both budget and time cost prevented conducting an original hedonic property study, and therefore the DEIS relied upon existing studies in the literature for the value of water quality. While there were no such studies in Montana, there were several for the mid-west and east. The results of these other studies provide a range of estimates of the likely benefits that maintaining the existing water quality would have on house prices. As discussed in the DEIS, prior to utilizing these studies for this purpose, this type of benefit transfer is routinely done by federal agencies in just these circumstances. While reliance on benefit transfer is not as accurate as a carefully conducted original study, to omit providing any range of effects would leave in the reader's mind no idea of whether the effects of water quality on property values was substantial (20-40%) or extremely minor (less than one percent). Providing the range in the literature of 3% to 9% gave some perspective on the **relative** magnitude of the effects that might occur in the Gallatin River area. However, the insight that the housing market is driven more by skiing than fishing suggests that changes in water quality may not have as large an economic effect as it does elsewhere. Short of finding a western skiing community where a similar economic study has been conducted, it is difficult to accurately know the magnitude of water quality effects on property values.

2.4.2.2 Population and Gallatin County Economy Statistics

Comment 49: "In summary, a complete and more detailed analysis of the Gallatin County economy suggests the rapid growth is not due 'to the abundance of natural amenities and protection of those amenities in the region' rather, Gallatin County has a diverse economy where basic industries explain the short-run and long-run trends."

Response: The inference that growth in the area's population (11.5% from 2000 to 2004) and economy was due to natural amenities was reached by the authors cited in the DEIS (Rasker and Hansen 2000). This conclusion was based on their detailed analysis of the greater Yellowstone region, of which Gallatin County is part. As noted by the commenter, it is likely that some of the 11.5% increase in Gallatin County's population was also due to the growth in basic industries such as manufacturing in the Bozeman area. This growth in basic industries as a contributor to growth in Gallatin county population should have also been mentioned in the DEIS along with the Rasker and Hansen (2000) interpretation as well. Thus the following is added to Section 3.5.3.1. (page 86) of the DEIS at the end of the 3rd sentence in the paragraph of text:

> *Some of the 11.5% increase in Gallatin County's population was also due to the growth in basic industries such as manufacturing in the Bozeman area.*

This sentence is now included in the revised section below.

Population

Comment 50: Commenters noted that the text in Table 3.5-1 states 2005 but the sources are 2003, and that no date or original source was reported for Table 3.5-2, Table 3.5-3, Table 3.5-4, and Table 3.5-5.

Response: The DEIS contained an error in the date, which should have read 2004 for Gallatin County population in 2004, not 2005. The source of the 2004 population estimate for Gallatin County was from the State of Montana's Table 1, Annual Estimates of the Population for Counties of Montana April 1, 2000 to July 1, 2004, Available online at http://ceic.mt.gov/Demog/estimate/pop/County/CO-EST2004-01-30.htm.

The source data for Tables 3.5-2, 3.5-4, and 3.5-5 (Sonora Institute 2003a, 2003b) and 3.5-3 (Sonora Institute 2003b) were provided in the DEIS. Tables 3.5-2 and 3.5-3 should have stated the data are for 1999. Regarding Table 3.5-4, the year (2000) is given in the title of the table. Table 3.5-5, which addresses employment by industry does use data from the U.S. Census Bureau (2000), which includes North American Industrial Classification System (NAICS) labor category definitions.

Section 3.5.3.1. (Page 86 of the DEIS) is revised to read as follows (new text in italics):

> The population of Gallatin County increased by 11.5% from 67,831 in 2000 to 75,637 as of *2004*, according to the Montana Department of Commerce (2006). This increase in population continues an existing trend, which Rasker and Hansen (2000) attribute to the abundance of natural amenities and the protection of those amenities in this region. Gallatin County's population is dominated by the city of Bozeman, which has become a year-round gateway to numerous outstanding recreation opportunities in the area, including skiing, hiking, rock and ice climbing, rafting, and fishing. *Some of the 11.5% increase in Gallatin County's population was also due to the growth in basic industries such as manufacturing in the Bozeman area.* The West Yellowstone CCD population was estimated at 2,887 for *2000*, while Big Sky CDP was estimated at 1,221 residents (Table

3.5-1). These latter two populations increase with the arrival of summer and winter visitors, respectively. The West Yellowstone CCD has the highest median age at 38 years, followed by Big Sky CDP at 34 years, and Gallatin County at nearly 31 years.

Table 3.5-1 [DEIS]. Population and median age in the study area *in 2000* (Sonoran Institute 2003a, 2003b; *2000 Census*).

	Gallatin County	**West Yellowstone CCD**	**Big Sky CDP**
Population	67,831	2,887	1,221
Median Age	30.7	38.1	34.3

Comment 51: A commenter stated that a more complete analysis would examine trend data for population, income, housing, as well as data on local taxation, utilities, health/safety, law enforcement, fire protection, emergency medical services and medical facilities.

Response: Given the study time and budget constraints, trend data were not deemed essential for these sectors of the economy. Data on many of the other sectors (e.g., health/safety, law enforcement, fire protection, emergency medical services and medical facilities) were not expected to change significantly with ORW designation (especially with the mitigation measures of advanced treatment or centralized treatment).

Employment Patterns

Comment 52: Several commenters made the following statements regarding employment patterns. A draft comprehensive study being conducted by the State of Montana's Department of Commerce shows that an estimated 10,000 jobs have been created by all economic activity in the Big Sky area. A substantial number of those jobs are associated with construction. At the very least the EIS should not go forward without first waiting for the final draft report from Department of Commerce. "..it is important that the DEIS rely on the most current data available. Next month in November, Susan Ockert, economist with Montana Dept. of Commerce is due to publish Economic Impacts of Big Sky. … DEQ should consider and incorporate Ms. Ockert's analysis in any final EIS and ROD." The figures in the DEIS showing only 274 jobs are generated in these industries is absurd. "Any person who has stood at the intersection of Highway 191 and the Big Sky Spur Road knows empirically there are more than 274 workers in involved in the Big Sky CPD."

Response: The employment figures in the DEIS were obtained from the U.S. Census Bureau from the latest census (2000). They report that 110 people living in Big Sky were employed in construction. In Yellowstone CCD the census reports another 164 construction workers residing in this area, and hence a total of 274 workers. It is true that some fraction of the 2000 U.S. Census estimate of 5,249 construction workers living in Gallatin County (reported in Table 3.5-5 of the DEIS) probably commute to construction jobs in Big Sky, but this number is not known. But given the construction boom in Bozeman, it seems unlikely that a majority of the Gallatin County construction workers work in Big Sky.

DEQ obtained an advanced copy of parts of the Susan Ockert's (Montana Department of Commerce) analysis referred to by the commenters. In that report she estimates 3,784 workers were employed in the Big Sky area in residential and commercial construction in 2005. This

estimate seems high since the most recent Bureau of Economic Analysis (2003) employment figures for all of Gallatin County is 6,184 construction workers. For the Montana Department of Commerce number to be accurate would mean 61% of all construction workers employed in Gallatin County work in Big Sky. Given the construction boom in Bozeman, it does not seem likely that over half Gallatin county construction workers work in the Big Sky area. Emails from Ms. Ockert suggest that perhaps some of the Big Sky construction workers are from outside the Gallatin County area. A discussion of Ockert's construction worker estimate is added to the FEIS, with a note of caution that her estimates may be high.

Further, the 10,000 jobs referred to by the commenters includes the current 2,000 jobs associated directly with the ski industry, which will not change with or without ORW. The direct job estimate in Montana Department of Commerce from ALL economic activity is 8,868 in Big Sky. (This estimate seems high given that there are between 55,000 and 60,000 working in all of Gallatin County, so 1 in 6 workers would have to work part of the year in Big Sky.) It is only with the indirect or "multiplier effects" throughout the **entire** State of Montana that this figure reaches the 10,000 jobs referred to.

Nonetheless in response to comments the year "2000" has been added to the title of Table 3-5.5 on page 89 of the DEIS:

> Table 3.5-5. Employment by industry in Gallatin County and Gallatin Canyon areas displayed in terms of number of jobs per sector and percentage of the total *in 2000*.

In response to comments the following text has been **added** below Table 3-5.5 on page 89 of the DEIS:

> *The employment figures are reported by place of workers residence, which is not necessarily where they work. This effect is most evident in the case of many resort and construction workers who often do not live where they work, and commonly commute to and from ski area towns throughout the west. In the case of construction workers, recent estimates by Montana Department of Commerce (2006) indicate 2,691 workers are employed in residential construction and 1,093 in commercial construction in the Big Sky area. However, if this estimate were correct, it would require that almost two-thirds of all construction workers living in Gallatin County to be working in Big Sky (based on the U.S. Bureau of Economic Analysis [2003] Regional Economic Information System [BEA-REIS] data on construction workers for 2003). Given the construction boom in the Bozeman area and throughout other areas in Gallatin County, this level of construction employment in Big Sky seems unlikely. Nonetheless, construction employment in all of the Big Sky area is certainly larger than the 274 construction workers living in Big Sky CDP and West Yellowstone CCD*

Comment 53: One comment was made as follows: "Many jobs and lifestyles depend upon a certain amount of growth being able to take place in this area… If the ORW designation is given to the Gallatin, we will …lose our ability to create and maintain jobs in the area…"

Response: ORW would only affect residential and commercial construction within the hydrologic footprint, which is a fraction of the land in the Big Sky area. With the mitigation of

combined chemical advanced treatment along with composting toilets, or centralized treatment, the reduction in building within the hydrologic footprint would be about one-third of potential additional build-out. Given the large number of current jobs associated with the current ski industry, which will not be affected by the ORW designation and adoption of advanced treatment within the hydrologic footprint, it is expected that Big Sky should be able to maintain most of its current economic base.

Comment 54: One commenter stated: "I fully support designating the Gallatin River an ORW. While I am a real estate agent in the Big Sky area, I just don't believe the hype that protecting water quality means cutting jobs."

Response: There should be minimal job loss for ORW with adoption of the mitigation measures such as zero-discharge and for centralized treatment. However, even with combined chemical treatment and composting toilets, construction employment could be reduced by about one-third during the period of build-out.

Comment 55: Overview of Valuation Issues. One commenter questioned the use of the contingent valuation method in the economic analysis. They stated the calculation of net economic value of fishing and other recreation on the Gallatin River use a controversial method and there is no evidence that studies cited in Section 3.5.3.8 of the DEIS meet the guidelines published in the Federal Register. Therefore the estimates of net economic value may not be reliable and should not be included in ORW. The contingent valuation method is a controversial method.

Response: The economic value of fishing of $71 per day used in Section 3.5.3.8 of the DEIS is not derived using the contingent valuation method, but rather from the travel cost method which relies on anglers' actual behavior. Thus, the commenter's concern about contingent valuation method does not apply to the value of fishing on the Gallatin River used in the DEIS. The fact that the $71 value relies upon the travel cost method is now mentioned in the revised section on the bottom of page 93:

> In a report from Montana Fish, Wildlife and Parks, a net economic value was calculated *using the Travel Cost Method* for a fishing day on the Gallatin using the average value per fishing trip divided by the average number of days per trip (Duffield et al. 1987).

Contingent valuation method was used to estimate the value of rafting and other river-based recreation. The National Oceanographic and Atmospheric Administration (NOAA) panel report referred to by the commenter was focused on the use of contingent valuation method to estimate the more difficult to measure passive use or non-use values, not recreation use values. For valuing recreation use (where survey respondents do have actual experience with the goods they are being asked to value) the U.S. Water Resources Council (1983—cited in the DEIS) recommends the contingent valuation method as one of two methods for valuing recreation. Therefore the contingent valuation method derived values are sufficiently reliable for use in valuing recreation in the DEIS.

2.4.2.3 Mitigation Costs Analyses

Comment 56: The $3,500 per SFE charge by the Big Sky Water and Sewer District is just one of the costs of using an advanced centralized system. There are also monthly fees.

Response: The commenter is correct. The monthly fees are relatively modest however, and depend on usage. Nonetheless, to be complete the DEIS should have mentioned the monthly fees. If the residence was used year round by 1-2 people, the fees amount to an additional $33 per month or $400 per year. If the residence is used on a part time basis - as is more than half the housing in Big Sky - then the monthly fee is closer to $50 a year.

Therefore, an addition is made in to the DEIS on the bottom of page 183 and top of page 184. The following sentence (in italics) is added to the middle of the paragraph on Wastewater Plant Investment Charge (PIC) charges.

> The PIC charged by Big Sky Water and Sewer District is $3,500 per SFE (www.bigskywatersewer.com). An SFE is based on a two bedroom-two bath residential unit. Each additional bedroom requires an additional 0.4 SFE. Thus, a three-bedroom condominium or house would require 1.4 SFEs, for a cost of $4,900. Studio apartments and hotel/lodge rooms are 0.7 and 0.75 SFEs, respectively. The Big Sky Water and Sewer District has set SFE values for commercial properties as well. (See www.bigskywatersewer.com website for the Single Family Equivalent Unit Conversion Schedule for a complete listing. (WSD 2006b)). *There is also a monthly charge that the owner of each unit would pay. If the residence was used year round by 1-2 people, the fees amount to an additional $33 per month or $400 per year. If the residence is used on a part time basis - as is more than half the housing in Big Sky - then the monthly fee is closer to $50 a year.* In addition to these treatment costs with a centralized community system, the developer would also have to put in the infrastructure costs such as sewer pipes from each building to the centralized system.

Comment 57: One commenter states that her family's livelihood (local outdoor retail shop and fishing outfitter) depends on both pristine resources and thriving development. She supports ORW designation and states the economic costs are not significant considering the cost of cleaning things up twenty years down the road.

Response: The importance of the Gallatin River to local economy is acknowledged in both Chapters 3 and 4 in the DEIS. As stated in Chapter 3, Section 3.5 of the DEIS, more than 50 river guides are licensed to guide the Gallatin River.

2.4.2.4 Minimal Cost of Complying with ORW

Comment 58: Nine comments were received indicating that the increased cost to new residential construction from complying with the ORW through advanced on-site treatment mitigation would be a very small percentage (1-3%) of the cost of a new house or condo in the Big Sky area, and well worth the cost.

Response: These comments are consistent with the DEIS that indicates the cost of purchase and operation of the advanced on-site treatment is a very small percentage of the cost of new

construction in the Big Sky area. Given new real estate sales data, and public comments received on the recent increases in lot and construction prices in the Big Sky area, the costs of these advanced on-site treatment systems now represent even a smaller fraction of the cost of a new home in the Big Sky area. However, the new mitigation option (presented in the FEIS but not the DEIS) of using both chemical removal for gray water and composting/incinerator toilets, raises this minimum level of advanced treatment cost. Using cost figures from Table 4.3-1 on page 153 of the DEIS, the costs go from the original DEIS cost of 1% of median house price ($3,200 treatment/$250,000 median house price) to 6.28% of median house price ($3,200+$12,500)/$250,000) for the combined system. At the high end the cost is now 10% of the $250,000 median house price ($12,800+$12,500). However, with recent increases in lot prices to $424,000 at the low end, cost of the combined system would be 3.7% to 6% at the high end of the lot price. When a house is added to the lot price, the costs of the combined system are closer to 2% of the total newly constructed house price.

2.4.2.5 Economic Benefits of ORW

Comment 59: Eight comments were received indicating there were substantial benefits to the local, county or state economy from protecting the current water quality through ORW designation. These benefits took the form of tourism, household and business relocation to the state, property values, and fishing and rafting.

Response: These individuals' comments are consistent with Chapter 3 and 4 of the DEIS which describes these benefits in more detail, and where possible, quantifies them with data from the Gallatin River area or from similar studies elsewhere.

2.4.2.6 Economic Costs of ORW, Percentage Costs of ORW on Prices of New Construction

Comment 60: Several commenters suggested the $250,000 median price of a new home in Big Sky that was used for analysis in the DEIS was far too low. "…the cost of compliance as expressed as a percentage of construction may actually be lower than estimated: houses in the Big Sky area are far more expensive than $250,000 median home price cited in the DEIS."

"The DEIS uses several different numbers in estimating the cost of mitigation on new home prices… Page E-4 it cites less than 1%, page E-14, it says 1-8%, and on page 98 it says 1-3%. The DEIS bases all of these figures on a median existing home price of $250,000. The number seems far too low for the Big Sky housing market. Assuming the actual median home price is considerably higher, the cost impact of installing alternative treatment systems should be much lower on a percentage basis."

Response: Costs were displayed in the DEIS both for the initial purchase cost of composting and incinerator toilets, as well as for hook up fees to a centralized system (page 153 of the DEIS). Given these costs range from $3,200 to $12,800, calculations yield the 1% to 5% cost per home shown on page 182 of the DEIS. This cost represents the upfront costs of advance treatment. However, the 30 year total cost (purchase, operation and maintenance) is in the range of $13,000 to $22,000, which would represent the upper end of the 8% cost figure cited on page E-14 of the DEIS. This figure represents the added cost per SFE of advanced treatment systems for

development in areas hydrologically connected to the proposed ORW reach of the Gallatin River.

The revised Chapter 3 (page 88) and 4 (page 182) of the DEIS use recent (fall 2005) real estate listings for residential lots in the Big Sky area (Big Sky Properties 2006). These sources suggest an average listing or "asking" price for residential subdivision lots 0.5 acre or less of $424,000. The actual selling price for some of these lots would be somewhat less, but it indicates that prices have probably risen substantially since when the 2000 Census was taken and the median house price was $246,000. Further, the costs of using both a combined gray water chemical treatment and composting toilet are revised on page 182.

The following discussion has been added to Chapter 3, on page 88 of the DEIS (new text in italics):

> These house price statistics are from the 2000 Census and do not reflect the recent rather large increase in house prices (24% increase from 2001 to 2004 – see Polzin 2005), which has made areas in Montana less affordable than at the time of the 2000 Census. *Recent real estate listings of subdivision-sized residential lots 0.5 acre or less in the Big Sky area (Big Sky Properties, 2005) suggests an average listing or "asking" price for these lots was $424,000. The actual selling price for some of these lots would be somewhat less, but it indicates that prices may have risen even more than 24% since when the 2000 Census was taken and the median house price was $246,000*. However, it is also worth noting that over half (57.3%) of housing in the Big Sky area is used primarily as seasonal, recreational or for occasional use, rather than being primarily owner occupied housing (U.S. Census Bureau 2000)."

The $424,000 price is now used on page 182 of the DEIS to give an upper range for price of subdivision-sized lots most directly affected by the ORW hydrologic footprint. Using this number, along with the initial cost of the combined chemical treatment of gray water and composting or incinerator toilets, results in less than a 3.7% increase in the cost of a lot, and an even smaller percentage increase in final house price (about 2%).

The revised text on page 182-183 of the DEIS is (new text in italics):

> The economic impact of these higher costs is calculated by comparing these higher initial costs to existing house prices in the area. As noted in Chapter 3, the median price of an existing home *in 2000 was* nearly $250,000 in the Big Sky area. *With an initial cost of $3,200 for two composting toilets (equal to one SFE) plus the initial cost of chemical removal ($12,500), the total compliance costs of ORW could represent an increase in costs of 6% to 10% of the median house price in 2000. Given that ORW designation would only affect new construction, and given the recent increases in lot prices, the cost of the combined chemical removal and two composting toilets would represent an even smaller percentage of new construction. The December 2005/January 2006 Big Sky Properties (Big Sky Properties 2005) the "asking" or listing price of subdivision size lots 0.5 acre or less was $424,000. Although the actual selling price for some of these lots would be somewhat less, this price provides an upper range on which to figure costs of lots in the*

Big Sky area (lot prices in the hydrologic footprint outside of Big Sky may well be significantly less). Given these average lot prices ($424,000) the low end cost of the combined chemical treatment system and composting/incinerator toilets would be 3.7% to 6% at the high end. Once the house is put on the property, the overall wastewater treatment cost increase of a combined system would represent about 1.5% to 2.5% of the finished house price.

The analysis of centralized system treatment has been revised on page 184 as follows:

Even if the cost of constructing small development systems is significantly higher than the cost of a PIC, it is still a small fraction of the estimated median price of a home in area *in 2000.* As noted above, the median price of an existing home was nearly $250,000 in the Big Sky area *in the year 2000*. Therefore, the $3,500 PIC is 1.4% of the median house price in Big Sky in 2000. *Given the recent rise in house and lot prices in Big Sky, the $3,500 PIC is now less than one percent. That is, with average subdivision lots (0.5 acres or less) with listing prices of $424,000 the PIC is 0.8%.*

These increases in costs are also equal to or smaller than the value the house retains from maintaining high water quality. As noted in Section 3.5.3.9 of the DEIS, regarding empirical estimates of the effects of water quality on property values, maintaining water clarity and absence of algae adds at least 3%, to as much as 20%, to house prices, with an average of about 6% (Boyle and Taylor 2001).

Comment 61: Several commenters stated that the cost of forgone development with no mitigation was significant. “The potential economic harm of this omission is significant and could bring measurable economic harm to the region on the order of magnitude of 100’s of millions of dollars per year, contrary to the Gallatin River EIS conclusion.” “The DEIS understatement regarding the economic impact of development in the area borders on the absurd.” According to the DEIS, the proposed regulation will decrease the amount of development from 692 lots to 75 lots.” “For a 3,000 square foot home, the cost is approximately $600,000, which does not include the lot. … However, lot prices can easily rise to millions. This results in a loss of $530 million or $53 million annually if we assume a build-out over ten years.”

Response: The commenters’ statements or calculations overstate the costs of complying with ORW even without mitigation. First, the socioeconomic analysis in the DEIS did not use lots as a measure of development, but rather dwelling units. About one half (50%) of the dwelling units in the hydrologic footprint in the Big Sky area are small subdivision lots of 0.17 to 0.25 acre, which generally do not sell for $1 million or more. About 25% of the lots are 1-2.5 acres, and only the remaining 25% of lots which are fives acre or larger sell for $1 million or more.

An analysis of available subdivision lots of 0.5 acre or smaller during the December 2005 and January 2006 period through Big Sky Properties indicates the average price for these lots is $424,000. The overall average for all lots advertised by Big Sky Properties during this time period was $844,140.

Further, not all the reduction in possible development in the hydrologic footprint occurs in the Big Sky Zoning District; about 25% of the dwelling units are in South Gallatin Zoning District or Spanish Creek-Karst Area. These areas outside of the Big Sky basin may not command the high prices per acre of lots in Big Sky.

Therefore the use of the $1 million per lot as a benchmark to calculate the costs of the ORW regulations under the Proposed Action without the mitigation greatly overstates the costs. Further, the net cost to society as a whole is only any loss in land value that cannot be replaced elsewhere. The building materials and labor can be re-employed elsewhere. Also, there are lots outside of the hydrologic footprint in the Big Sky area where the $600,000 house construction (labor and materials) can be undertaken if the house cannot be built within the footprint. Lastly, there are other ski towns in Montana and elsewhere in the west where the displaced construction materials can be utilized.

However, the average price per subdivision lot and other lot sizes is now used to estimate a rough opportunity cost of the ORW regulations without mitigation. Thus, the following is inserted on page 180 of the DEIS (between the first full paragraph and the second full paragraph) to reflect the cost of forgone development of the Proposed Action without mitigation:

> *With the Proposed Action of ORW designation without any mitigation, there would be a reduction in approximately 281 dwelling units in Single Family Equivalents (SFEs) on subdivision lots of 0.5 acre or less. The lost value of the buildable lots is estimated to be roughly $120 million using an average subdivision lot price of $424,000. Using the relevant larger lot prices for reduction in residential cluster 1 (one unit per acre) and 2.5 (2.5 units per acre) and residential cluster 5, 10 and 20, the total loss in lot values is estimated at roughly $300 million over the decade of build-out in the hydrologic footprint. There would of course be an associated loss of the property taxes that would have been paid on the associated houses that would have been constructed on these lots. However, to arrive at a net figure, this reduction in property taxes needs to be balanced with the reduction in services that would no longer be required without building.*
>
> *For individuals and small real estate developers/builders the loss of one or more of these lots could cause substantial financial hardship, leading to personal stress and possibly social/community stresses in attempting to cope with or aid these individuals or developers/builders.*

With regard to the costs of the Proposed Action with Mitigation, the net costs are now estimated using this same range of lot prices times the number of lots no longer buildable under ORW even with mitigation. The first type of mitigation analyzed is the combined chemical treatment and composting/incinerator toilets. The text dealing with the percentage costs this would represent to new construction involving a new lot and home has been revised. The loss in land values associated with the reduction in dwelling units that can be built using this combined approach is discussed.

The revised text on page 183 in the DEIS in between the first full paragraph and the second full paragraph is:

Specifically, revised table 4.4-6 (Table 2.3-1 FEIS) indicates that with the combined chemical removal and composting/incinerator toilets, those 281 SFEs on lots of 0.5 acre would not be buildable due to ORW even with this combined treatment. Only with zero discharge via centralized treatment or vaults would they be buildable. The value of these unbuildable lots would represent a cost of $120 million in forgone lot values over the decade of build-out. Associated with this loss would be the loss in associated property taxes, although that loss may be slightly offset by the reduction in services that would need to be provided.

For individuals and small real estate developers/builders the loss of one or more of these lots could cause substantial financial hardship, leading to personal stress and possibly social/community stresses in attempting to cope with or aid these individuals or developers/builders.

The adoption of the combined advanced subsurface wastewater treatment systems (chemical and composting/incinerator toilets) would allow more of the build-out potential within the footprint than the Proposed Action without mitigation. However, the number of dwelling units mitigated would depend on the types of systems used. The adoption of mitigating wastewater treatment systems, compared to without mitigation would result in less reduction in the current levels of employment in the construction and real estate sectors of Big Sky CDP and West Yellowstone CCD. In particular, construction employment might fall by about one-third with the combined advanced wastewater treatment. Some of this amelioration of the reduction in employment may arise because adoption of combined subsurface wastewater treatment systems would likely require additional employment in the installation and maintenance of these systems.

Only if zero discharge from small subdivision lots can be achieved would full build-out in the hydrologic footprint be obtained. Zero discharge would either require: 1) changes in state law to allow sealed vault systems; or 2) small-scale centralized treatment systems that were economically feasible (centralized systems are economically feasible for areas of higher density, but become less economically feasible as density decreases). In these cases full build-out could occur with ORW designation, and current levels of construction employment could continue during the build-out period in Big Sky and Gallatin County. Further, if sealed vault systems were allowed, these sealed septic, or gray water systems would need to be pumped every four years, and the sewage or gray water disposed of outside the study area, creating additional jobs in this industry.

2.5 Fisheries and Aquatic Resources

Comments related to fish and aquatic resources were recorded at the October 25 public hearing and four additional comments were received by DEQ on issues regarding the fisheries and aquatic ecology analysis in the DEIS. The comments generally fell into three areas: effects on the fishery; potential changes to angler populations; and use of aquatic organisms in the data review and assessment process.

2.5.1 Comment Summary

Comments related to fisheries and aquatic resources received at the October 25 public hearing were varied, but generally focused on the recreational fishery. Commenters requested that the benefits to and effects on the fishery be acknowledged by the Board in their decisions. Two commenters described anecdotal evidence that declines in water quality were already affecting the food web in the Gallatin River, particularly aquatic macroinvertebrates.

Several comments related to the recreational activities surrounding fishing have been addressed under the socioeconomics (Section 2.4) and land use (Section 2.3) responses in the FEIS.

2.5.2 Issues Raised and Responses

2.5.2.1 Geographic Extent of Analysis

Comment 62: The DEIS did not assess tributary habitat and water quantity in relation to the Gallatin River fishery.

Response: This comment points out the interconnectedness of the river's ecology. However, the legal framework of the ORW designation process and direction under MEPA limits the extent of our analysis to the reach of river that has been petitioned. Also, although water quantity is integral to fish health, it is not specifically addressed in the ORW legislation, and thus no further analysis is provided in this document.

2.5.2.2 Macroinvertebrates and Sampling Analysis

Comment 63: Two commenters noted that they believed that mayfly and stonefly populations were being "lost to pollution" in the Gallatin River.

Response: Although the data are not specific enough to document the trend for any one species, more detailed analyses of the benthic macroinvertebrate populations are provided in this section.

Comment 64: The macroinvertebrate analysis presented in the DEIS is inaccurate. The contention put forward in the DEIS that the macroinvertebrate data showed a trend of declining water quality is not correct.

Response: While recent macroinvertebrate sampling data are limited to Bollman's studies from 1999 to 2005 (Bollman 1999, 2002, 2003, and 2005), there are studies from the 1970s that document a pollution-sensitive macroinvertebrate community prior to initial development in the West Fork Gallatin River watershed (Stuart et al. 1976). Stuart et al. (1976) began their study

just after work began to build the Big Sky complexes at Meadow Village and Mountain Village. Their study found short-term impacts from development along the West Fork Gallatin River that changed the macroinvertebrate species composition from a pollution intolerant mayfly-dominated one to a pollution tolerant midge-dominated one between 1971 and 1974. When Stuart et al.'s data from 1971 and 1974 are compared to those collected by Bollman between 1999 and 2005, it is difficult to discern a statistically significant trend. However, a cursory look at the data does suggest that the benthic community is shifting from less pollution-tolerant orders such as the Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), to a more pollution tolerant, less diverse community dominated by Dipteran (flies) groups, especially the *Chironomidae* (midges) (Figure 2.5-1). At the site on the West Fork Gallatin River upstream of the Spur Road Bridge, mayflies have gone from comprising near 30 percent of the sample to less than 15 percent while fly and midge larvae have gone from comprising fewer than 12 percent to over 75 percent (Figure 2.5-1).

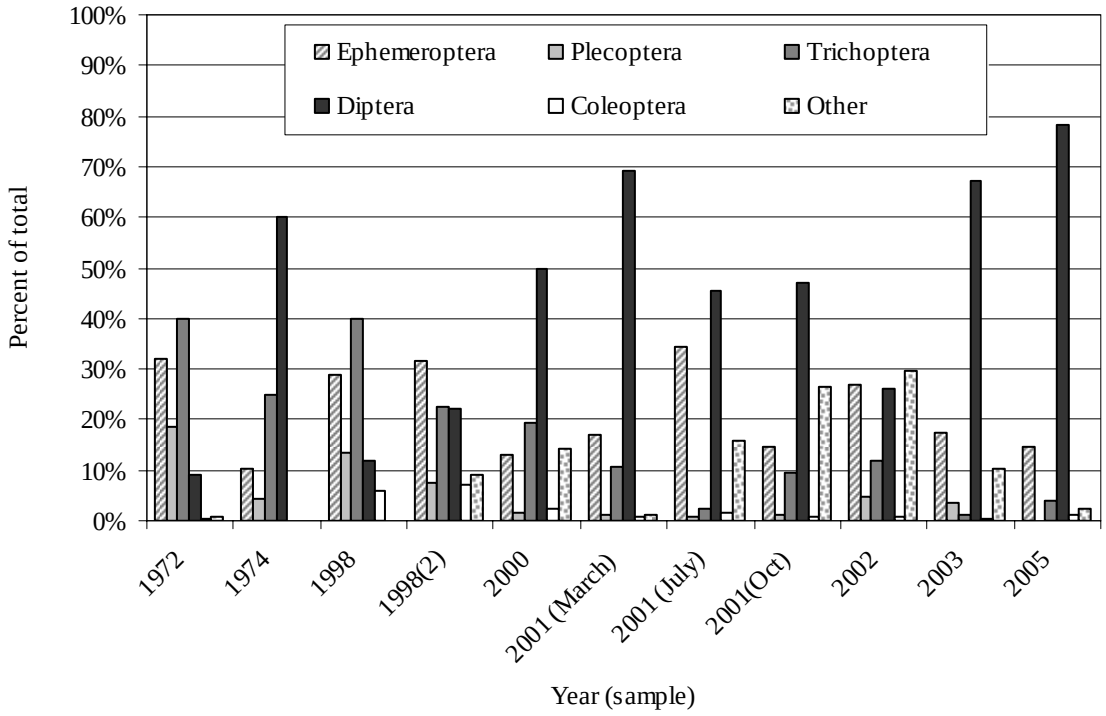

Figure 2.5-1. Benthic macroinvertebrate data displayed as percent of total sample by taxonomic order for the sample site on the West Fork Gallatin River upstream of the Spur Road Bridge. Sources for the data are Stuart et al. 1976; Bollman 1999, 2002, 2003, and 2005. A replicate sample was taken at the same site and same time in 1998, and three samples were taken at the same site during three different months in 2001. Dipterans include members of the midge family Chironomidae.

Combining the three pollution-intolerant taxa (Ephemeroptera, Plecoptera and Trichoptera; known as 'EPT') and comparing their total percent against the percent of Dipteran (pollution tolerant) taxa, the trend is even more apparent (Figure 2.5-2). The relative percent of EPT

compared to percent of Dipterans has reversed since 1998 (Bollman 1999, 2002, 2003, and 2005) (Figure 2.5-2).

Although the trend does not appear to persist for samples from the Jack Bridge site below the confluence of the West Fork Gallatin River and the mainstem Gallatin River, the contribution of nutrients from the West Fork Gallatin River is likely to cause degradation of the water quality in the mainstem Gallatin River (Figures 2.5-3 and 2.5-4).

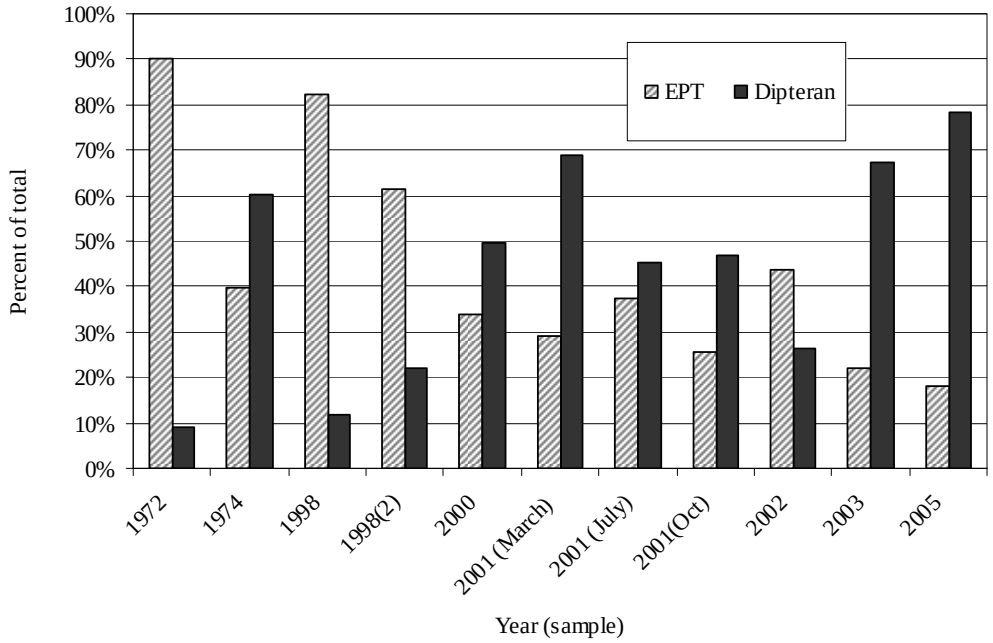

Figure 2.5-2. Benthic macroinvertebrate data displayed as percent of total sample for the sum of all Ephemeroptera, Plecoptera, and Trichoptera (EPT) and the Dipteran taxa for the sample site on the West Fork Gallatin River upstream of the Spur Road Bridge. Source data from Stuart et al. 1976; Bollman 1999, 2002, 2003, and 2005. A replicate sample was taken at the same site and same time in 1998, and three samples were taken at the same site during three different months in 2001. Dipterans include members of the midge family Chironomidae.

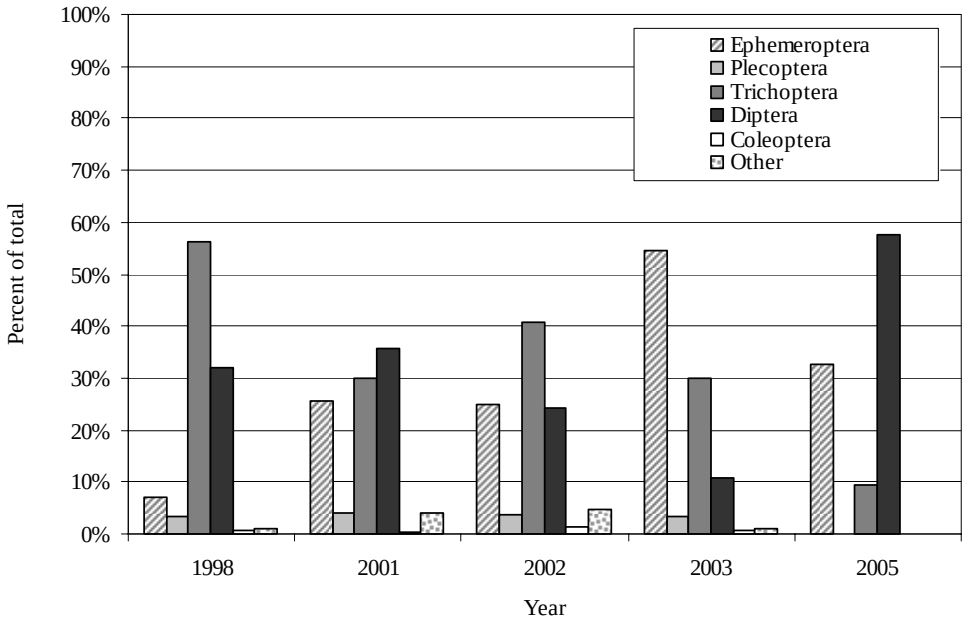

Figure 2.5-3. Benthic macroinvertebrate data displayed as percent of total sample by taxonomic order for the sample site on the Gallatin River just below the confluence of the West Fork Gallatin River at Jack Bridge. Sources for the data are Bollman 1999, 2002, 2003, and 2005. Dipterans include members of the midge family Chironomidae.

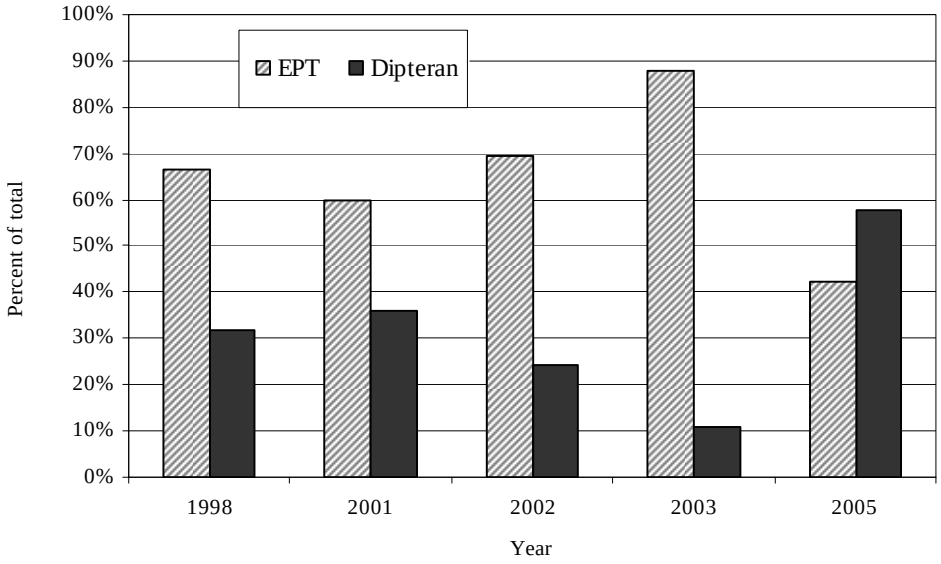

Figure 2.5-4. Benthic macroinvertebrate data displayed as percent of total sample by taxonomic order for the sample site on the Gallatin River just below the confluence of the West Fork Gallatin River. Sources for the data are Bollman 1999, 2001, 2003, and 2005.

Comment 65: Bollman (2005) suggests that low flows due to drought and possibly subsequent thermal effects (i.e. warming) may have exacerbated the changes in the macroinvertebrate community.

Response: This comment accurately describes of one of Bollman's (2005) conclusions. However, Bollman did not provide data or analysis to support these speculations. While low flows and warming can increase the impacts of nutrient levels in streams, the actual nutrient content in the water is the concern. DEQ water quality trigger values are set using the 7Q10 flow, the 7-day consecutive, 10-year low flow level; therefore, nutrient levels at low flows should be the focus of concern. During drought years stream fauna experience even greater stress with the same nutrient load as they would in a normal or high flow year where increased flows dilute the nutrients as they enter a stream. Therefore, any long-term reductions in flow would only serve to increase the negative impact of the No Action Alternative and the benefits of the Proposed Action Alternative.

Comment 66: The presence of whirling disease in the Gallatin River is another reason to be concerned about water quality in the proposed ORW reach.

Response: Although, no evidence of whirling disease infection has been documented in the proposed ORW reach, DEQ documented the presence of *Tubifex tubifex* in the West Fork in 1997 during their TMDL data assessment (DEQ 2006d, Kerans, et al. 2005). Kerans et al. (2005) found that temperature is the most likely limiting factor limiting the spread of whirling disease to the upper Gallatin River.

Comment 67: DEQ should identify all data used to determine the trend in water quality degradation.

Response: In addition to the benthic macroinvertebrate studies described above, the recently released DEQ report to EPA on impaired Montana waterbody (303(d)) listing shows the West Fork Gallatin River as downgraded from "partially supporting" in 2004 to "not supporting" in 2006 for both the cold water fishery, and contact recreation such as swimming (DEQ 2006c, pg D-22). In addition the Middle Fork of the West Fork Gallatin River has been downgraded from "partially supporting" to "not supporting" contact recreation (DEQ 2006c, Pg D-22). In other words, DEQ does not think it is safe for individuals to swim or "wet-wade" fish in these waterbodies. The possible causes listed for these reductions to beneficial uses are "septics and decentralized systems and land development/clearing" (CWAIC 2006). The specific pollutants listed include nitrogen, phosphorus and fecal coliform bacteria (DEQ 2006c).

2.5.2.3 Fisheries Data Analysis

Comment 68: The linkage between angling success and economic benefit is not clear in the socioeconomic or fisheries analyses. The impact of "lost anglers due to reductions in water quality" is not significant in the context of other economic sources in the study area.

Response: Although the work relied on in the DEIS is from the 1990s, the general premise that the fishery of the proposed ORW reach of the Gallatin River is important to the local economy is well established. The second portion of this comment seems to imply that reductions in water

quality sufficient to impact the fishery are acceptable. DEQ strongly disagrees with this assertion. Nondegradation policy requires the maintenance of designated uses of high quality waters such as the Gallatin River (See Section 1.3 DEIS). The fishery of the Gallatin River was one of the reasons cited by the Board to accept the ORW petition (See 75-5-316(4) MCA).

The FEIS includes references to the most recent water quality data related to fisheries and emphasizes the acknowledged degradation of the water quality of the West Fork Gallatin River to the point of "non-support" for the coldwater fishery due to nutrient pollution (DEQ 2006c App D-66). It is reasonable to assume that the nutrient-degraded waters from the West Fork Gallatin will impact the overall water quality of the mainstem Gallatin River. Declines in the fishery of the Gallatin River may result from the continued nutrient input originating from these 303(d) listed streams. In the absence of ORW designation, these impacts may increase as more potential nutrient sources are allowed within the footprint.

Comment 69: A comment was made that the DEIS on page 198 states that:

> "With full build-out, levels of nitrate are likely to remain well below this [2.0 mg/L] threshold, assuming the 153 gpd effluent (Nicklin 2000a). Figure 4.3-5 shows that at 652 SFE the additional nitrate concentration would be less than 0.04 mg/L above the existing background levels."

The commenter states that these levels are not sufficient to cause harm to the fishery.

Response: The DEIS (page 198) goes on to explain that background nutrient levels in the study area already approach one-half of the threshold that might adversely affect the fishery:

> "Figure 4.3-6 shows that background levels currently approach 1.0 mg/L at one of the BWTF monitoring sites, and that the background nitrate levels appear to be increasing (BWTF 2006). If full build-out was completed at current standards for nutrient loading, then nitrate levels could increase to 1.02-1.04 mg/L nitrate. These calculations assume no leakage from the Big Sky County Water and Sewer District and continued zero discharge from their facility. If conditions of the Big Sky County Water and Sewer District MPDES permit change, or if their facility infiltration rate increases, it is not unreasonable to assume that background nitrate levels will continue to increase and that total levels might approach the 2.0 mg/L threshold. This level of nitrate would not cause the recreational fishery to decline rapidly, but would be likely to adversely affect rainbow trout fry and eggs (Table 4.7-2) (Kincheloe et al. 1979). Since cold water temperature in the proposed ORW reach already limits rainbow trout growth, this added stress to the adults could also cause adverse effects on adult growth, reproduction, and survival (Crunkilton and Johnson 2000)."

2.5.2.4 Use of the TMDL Process

Comment 70: The existing TMDL process should be used to protect the water quality of the Gallatin River.

Response: The reach of the Gallatin River proposed for ORW designation is not currently listed as impaired, and would have to be declared as such before any TMDL process would provide

protection. Therefore, waiting for a detectable level of degradation to occur would not meet the petitioner's request, and would not provide a similar level of protection for the Gallatin River. The TMDL process would only be initiated after sufficient credible data were collected to affirm impairment, and would not meet the intent of the petitioner, which is to prevent impairment of water quality.

Fisheries-related issues raised that are outside of the scope of the EIS included: the ability of the ORW to protect in-stream flows. This concern was addressed in the scoping report.

2.6 Air Quality

2.6.1 Comment Summary

One comment was received by DEQ regarding the potential impact of incinerator toilets on air quality.

2.6.2 Issues Raised and Responses

Comment 71: Analysis of how expanded use of incinerator toilets might affect air quality in the study area was not included in the DEIS.

Response: Two leading incinerator toilet manufacturers were consulted regarding air emissions from their products (mention of product names is not an endorsement by DEQ):

1) E.B. Blankenship, technical/sales representative from INCINOLET®, indicated that their electric incinerator toilet utilizes a platinum catalyst to keep toilet exhaust odor-free. Heat and smoke are filtered through the catalyst and out a vent pipe to the atmosphere. INCINOLET® has not conducted studies on chemical makeup of the toilet's exhaust; however the main by-product of any combustible organic is typically carbon dioxide. The INCINOLET® toilet is a National Sanitation Foundation certified product (NSF P157).

2) STORBURN, a leading manufacturer of gas-fired incinerator toilets offers a written guarantee that "STORBURN GIVES OFF NO FOUL ODORS - INSIDE OR OUTSIDE". According to STORBURN's website (http://www.storburn.ca/info.html), "*the STORBURN toilet reduces untreated human waste to sterile mineral ash and harmless water vapor"* and "*the STORBURN toilet is self-contained and does not discharge any effluent into the soil or harmful gas into the atmosphere. All that remains after the incinerator cycle is sterile ash."* Officials with STORBURN were not available at the time of this comment response.

In summary, it is not expected that use of these units in multiple locations would impact regional air quality; the primary air emissions from these units are expected to be water vapor and/or carbon dioxide.

2.7 MEPA Process

Several comments were made at the October 25, 2006 public hearing and at least ten additional comments were received by DEQ on issues related to MEPA or implementation of the ORW designation. Some of the comments also raised legal questions related to DEQ's authority and how the ORW may be interpreted if approved. The comments were diverse, but several issues came up repeatedly: scope of the analysis; public involvement; tiering with other environmental documents; and the timeline and funding of the EIS.

2.7.1 Comment Summary

2.7.1.1 MEPA Process

Comments were made related to the timeline and budget for the EIS. Some commenters felt that neither was adequate for a complete assessment. Others felt that the timeline had been imposed without good cause or substantiation. There were several comments on the adequacy of the DEIS. Comments specific to resource area analyses are addressed under the corresponding section of this FEIS. Comments related to compliance with MEPA are addressed below.

2.7.1.2 Alternatives and Analyses

Comments on the analyses for each resource area are addressed in their respective sections of this FEIS. Commenters expressed concern that the range of alternatives was too limited and that additional alternatives should be pursued.

2.7.2 Issues Raised and Responses

2.7.2.1 MEPA Process and Timeline

Comment 72: The DEIS timeline and budget imposed by DEQ did not allow for adequate analysis of impacts and issues.

Response: The deadline noted for this EIS was the outcome of establishing a schedule for completion that meets the timeframes required under MEPA (see 75-1-208(4)(a), MCA). The budget constrained the extent of some analyses, but did not preclude adequate analysis. Existing reports were used and few areas were found where data were lacking in quantity or quality. The existing budget prevented extraneous studies and focused the EIS.

2.7.2.2 Acceptance of the Petition

Comment 73: The Board failed to address how the proposed ORW meets all of the six criteria listed under 75-5-316(4), MCA.

Response: The text preceding the list of possible reasons for petitioning a water body for ORW designation states, "However, the board may determine that compliance with *one or more* of these criteria is insufficient to warrant classification of the water as an outstanding resource water" (Emphasis added). Therefore, the statute requires that at least one, but not necessarily all, of the criteria be met for the Board to be able to determine that ORW classification is warranted.

2.7.2.3 Purpose and Benefits of Proposed Action

Comment 74: The DEIS does not adequately describe the need for the proposed action.

Response: Under MEPA the purpose and benefits section (Chapter 1 in the DEIS) must address the reason why an agency is compelled to make a decision to implement an action. Under 75-5-315, MCA, if a petition to designate a waterbody as an ORW is presented to the Board and the Board decides the petition has merit, the Board must require the preparation of an EIS (75-5-316(6), MCA) (See pg 2 DEIS). Although the Board may accept the petition, the Legislature ultimately decides whether or not to designate the waterbody as an ORW. There are no provisions in Montana law for the Board to make an independent designation of an ORW without a petition.

Comment 75: The current water quality protection process adequately protects the Gallatin River and the EIS was not necessary.

Response: Under 75-5-316(3), MCA, the EIS must address whether there is *no other effective process available that will achieve the necessary protection* as ORW designation. As detailed in the DEIS on pages 15-18, current regulations would allow some level of degradation of water quality from point-source pollution:

> "DEQ, in accordance with Board rules and statutes, may authorize water quality changes above the nonsignificance threshold (i.e., degradation) if a discharger demonstrates by a preponderance of evidence that:
>
> - there are no economically, environmentally, and technologically feasible modifications to the proposed project that would result in no degradation;
> - the proposed project will result in important economic or social benefits that exceed societal costs of allowing degradation;
> - existing and anticipated uses of state waters will be fully protected; and
> - the least degrading water quality protection practices will be used (75-5-303(3), MCA).
>
> Once DEQ has reviewed the evidence, it issues a preliminary decision, and a 30-day public comment period begins. At the end of the comment period, DEQ issues its final decision, which may be appealed to the Board by persons who have an economic interest that might be directly affected. DEQ may review and revise authorizations to degrade once every five years and may modify the authorization as necessary. Under the No Action Alternative, permittees could continue to use this process to gain approval, even if water quality degradation would occur."

Therefore, the DEIS does demonstrate that ORW designation would provide a distinctly different level of water quality protection than would the No Action Alternative. The level of protection of water quality is the only standard of measure that is the focus in the ORW designation process.

Comment 76: DEQ must show why water quality is "of such importance as to outweigh any other societal problem."

Response: This level of analysis is not called for in 75-5-316, MCA, nor is it required under MEPA.

2.7.2.4 Alternatives and Analyses

Comment 77: The language in the alternatives analysis was too vague regarding the potential for water quality degradation in the proposed ORW reach. The DEIS uses words like "potentially," and "could be degraded." Therefore, the DEIS does not demonstrate a need for ORW designation.

Response: The recent DEQ 303(d) listing shows that water quality degradation is occurring and has occurred specifically in the West Fork of the Gallatin River (DEQ 2006c). The recently released DEQ report to EPA on impaired Montana waterbody (303(d)) listings shows the West Fork Gallatin River as downgraded from "partially supporting" in 2004 to "not supporting" in 2006 both the cold water fishery and contact recreation such as swimming (DEQ 2006c, pg D-22). In addition, the Middle Fork of the West Fork Gallatin River has been downgraded from "partially supporting" to "not supporting" for contact recreation (DEQ 2006c, Pg D-22). In other words, DEQ does not think it is safe for individuals to swim or wet-wade fish in these waterbodies. The possible causes listed for these reductions in beneficial use are "septics and decentralized systems and land development/clearing" (CWAIC 2006). The specific pollutants listed include nitrogen, phosphorus and fecal coliform bacteria (DEQ 2006c).

Comment 78: The range of alternatives considered in the DEIS was inadequate.

Response: There are limited ways to meet the level of protection afforded by ORW designation which requires that DEQ may not:

a) grant an authorization to degrade under 75-5-303, MCA, in outstanding resource waters; or
b) allow a new or increased point source discharge that would result in a permanent change in the water quality of an outstanding resource water (75-5-316 (2), MCA).

Given the specificity of the requirements of ORW, DEQ believes that the DEIS examined and described all reasonable alternatives to the Proposed Action. The commenters did not suggest any additional alternatives for consideration.

2.7.2.5 Extension of the ORW Designation to the Tributaries

Comment 79: Because the footprint encompasses portions of the lands surrounding the tributaries, that ORW designation is "*de facto*" extended to these tributaries.

Response: Although the waters in the tributaries do travel their full length to the proposed ORW reach of the Gallatin River in less than the one-year travel time criterion, surface water travel time was not used to delineate the footprint. The footprint encompasses areas where the shallow aquifers (groundwater) are in direct hydrologic connection with the Gallatin River or principal tributaries to the Gallatin within the study area, and therefore are likely to transmit contaminants to the river (Appendix F, DEIS). The footprint thus delineates the area where the groundwater is likely to reach the mainstem of the Gallatin River within one year. If the footprint were constructed to include all lands with a similar hydrologic connection to the tributaries, the acreage covered would be significantly greater.

2.8 Other Comments

Although every comment received was read and assessed as part of the public involvement phase for this FEIS, some comments were outside of the scope of work for the EIS analysis. Many of these comments have been addressed earlier in this document as well as in the scoping document (DEQ 2005). This section lists additional comments that are not addressed in the FEIS, and provides a brief explanation for their omission.

2.8.1 Geographic Scope

Several comments were made regarding increasing or reducing the geographic extent of the ORW designation. One commenter requested that the FEIS profile several other waters that might be eligible for ORW status.

The ORW reach is defined by the initial petition (American Wildlands 2001), and DEQ does not have the authority to change the extent of the ORW designation (75-5-316 (3)(c), MCA). Analysis of unrelated waterbodies is also beyond the scope of the DEIS.

2.8.2 Impacts to Water Quantity

Commenters requested analysis of water quantity and effects from development on in-stream flows. While water quantity does have some bearing on the concentration of pollutants within a water body, the ORW designation does not address water quantity as part of water quality; therefore, an independent analysis of water quantity is beyond the scope of this FEIS.

2.8.3 Nonpoint Source Regulation

Some commenters listed several specific materials (such as de-icers) used in various industries (e.g. road maintenance) that would need to be evaluated as potential point sources. These materials do not reach the river via any sort of discrete conveyance, which is part of the definition of a point source (75-5-103, MCA). Therefore, the potential for such materials to affect the water quality of the river was qualitatively assessed in the DEIS, but their use would not be controlled differently under the ORW designation (DEIS page 9) because ORW requirements are limited to point discharges.

2.8.4 Impacts to Highway Safety

Montana Department of Transportation (MDT) and individual citizens expressed concern that ORW designation might limit or reduce the ability of MDT and the County to conduct road maintenance and implement their safety improvements projects as planned. DEQ reviewed MDT's Environmental Assessment for proposed safety improvements and did not find any actions or aspects of the project that would require alterations in the current permitting and MEPA process (FHWA and MDT 2005). As noted above and under Section 2.2.2, ORW designation would not require any additional regulatory or permitting actions for nonpoint sources typical of transportation and road maintenance projects. In addition the temporary surface water discharge permits (318 permits) normally applied for as part of road construction and maintenance projects would not constitute a "permanent change" in water quality and therefore would not violate ORW requirements. Although MDT did participate in the scoping process, its comments were filed two months after the scoping period closed.

Chapter 3: Description of Public Involvement

The public involvement process is the core of MEPA. Several opportunities are provided during the MEPA process including public scoping, public comment on the DEIS and public meetings and hearings where members of the public can present their comments to the agencies involved. This chapter describes the opportunities for public involvement provided by DEQ during the preparation of the EIS for the proposed ORW designation of the Gallatin River from the Yellowstone National Park boundary to the confluence with Spanish Creek.

DEQ opened the scoping period for the Gallatin ORW Designation Environmental Impact Statement (EIS) on November 25, 2005. On December 12, 2005, DEQ held a public meeting in Gallatin Gateway, Montana, at the Gallatin Gateway Community Center. The meeting was well attended and several resource area representatives from DEQ and other State agencies were present to field comments from the public. Greg Hallsten, project manager for DEQ, moderated the meeting. Comments made at the meeting were collected and re-typed by DEQ, and sent to Garcia and Associates (GANDA) for inclusion in the scoping report. Comments received via postal mail or e-mail were forwarded to GANDA. The scoping period closed on December 28, 2005. The scoping report was published on the DEQ (http://www.deq.mt.gov) website on January 19, 2006.

DEQ distributed the Gallatin ORW Designation DEIS on September 8, 2006. One hundred and fifty copies were printed and mailed to local public libraries as well as to individuals and organizations that requested a printed copy. An electronic copy in PDF format was posted on the DEQ website to allow broader distribution of the information. This distribution via mail and website opened the comment period for the DEIS. On October 25, 2005, DEQ held a public hearing in Gallatin Gateway at the Gallatin Gateway Inn. All members of the Board of Environmental Review (Board) were present: Joe Russell, Heidi Kaiser, Kim Lacey, Don Marble, Bill Rossbach, Robin Shropshire, and Gayle Skunkcap. Joe Russell, Chairman of the Board, presided over the meeting and provided instructions to commenters as to format and procedures for presenting comments. A court reporter typed minutes of the meeting. The meeting was well attended.

Resource area representatives from DEQ presented introductory information on the EIS process and the proposed ORW. Greg Hallsten, EIS coordinator and Project Manager for DEQ, introduced the Board and outlined the MEPA process specific to this EIS. Bob Bukantis and Eric Regensburger presented technical and policy information on the ORW and on some of the findings presented in the DEIS. Comments made at the meeting were collected by the Board and oral comments were typed by the court reporter. Comments received via FAX, postal mail, or e-mail were forwarded to GANDA. The comment period on the DEIS closed on October 27, 2006. MEPA requires a minimum 30-day comment period; this comment period lasted 49 days.

The public hearing also addressed the rule-making process and proposed rule. The Board accepted written and oral comments on amending ARM 17.30.617 to designate the mainstem of the Gallatin River from the Yellowstone National Park boundary to the confluence of Spanish Creek as an ORW and to amend ARM 17.30.638:

(1) to add a new subsection clarifying that discharges to ground water with a direct hydrologic connection to an ORW are within the statutory mandate prohibiting any permanent change in the water quality of an ORW resulting from point source discharges, and

(2) to clarify that existing point sources or ground water sources that will result in discharges to an ORW, which have been approved, authorized, licensed, or permitted prior to the effective date of the ORW designation, are not subject to the prohibitions in the statute against causing permanent changes in the water quality of an ORW.

The comment period on the proposed rules ended on November 2, 2006. Comments on the proposed rule will be addressed by the Board.

Chapter 4: Public Comments Received

As required under ARM 17.4.619, the sources of all written and oral comments on the DEIS, including those obtained at public hearings, must be included in the FEIS. The following is a list of people, and any affiliations they provided that commented during the public comment period for the Gallatin River ORW Designation DEIS. Comments are separated below as to whether they were written or oral; a few individuals commented both orally and in writing. The written comments (including those emailed or Faxed) were electronically scanned and are found in Appendix A.

Table 4.1. Sources of comments on the Gallatin ORW DEIS received by DEQ during the public comment period from September 8 to October 27, 2006. Affiliations and representation are listed as provided by the commenter.

Name	Affiliation	Representing
Allen, Don; Trenk, Peggy; Roberts, Byron; Hegreberg, Cary	Western Environmental Trade Association	
Alvin, Katie		
Bauchman, John		
Becker, Mike and Stephanie		
Bell, James		
Bosse, Scott	Greater Yellowstone Coalition	
Breeden, Samantha		
Breeding, Noreen		
Cain, Clinton and Judith		
Clifford, Matt	Clark Fork Coalition	
Dolan, James J.	Spanish Peaks Holdings, LLC	
DuBose, Robert		
Durham, Rebecca		
English, Alan	Gallatin Local Water Quality District	
Gallik, Brian K.	Goetz, Gallik & Baldwin P.C.	Westland Enterprises, Inc. and Simkins Holdings
Hansberry, Charles E.	Garlington, Lohn & Robinson PLLP	Yellowstone Developments LLC and Yellowstone Mountain Club
Haugen, Gorden	Headwaters Sportsman Association	
Heath, Rebecca	Forest Supervisor, GNF	
Hether, Nicholas		
House, Verne		
Johnson, Jim		
Kelleher, Kevin		
Kirkland, David and Julie		
Kommers, Faye		
Lynch, Jim	Montana Department of Transportation	
Martin, Jenny		
Mest, John		
Nicklin, Michael E.	Nicklin Earth & Water, Inc.	
Ossorio, Eric		
Persons, Jacquie		

Table 4.1. Sources of comments on the Gallatin ORW DEIS received by DEQ during the public comment period from September 8 to October 27, 2006. Affiliations and representation are listed as provided by the commenter.

Name	Affiliation	Representing
Regnerus, Shawn	American Wildlands	American Wildlands
Sears, Lance		
Straehl, Sandra	Montana Department of Transportation	
von Pentz, Robert		
Walden, Richard	Richard Walden Law	Swan Range Log Homes, LLC
Wasia, Chris		
Wiegmann, Ralph; Truman, Suzanne		
Zarrabian, Saiid	Lone Peak Homes, Inc.	
Ansley, Charles		
Davis, Amy		
DeArmond, Ron		
Dolan, Brian		
Ellingsen, Kris		
Garvey, Lydia		
Grundman, Dennis		
Johnson, Katherine		
McClelland, Doug and Liza		
McMahon, Tom		
Patterson, Anna		
Ritter, Robert		
Schreiner, Suzanne		
Schuiery, Kathleen and Duane		
Steele, Bill and Carol		

Oral Comments presented at the public hearing on October 25, 2006. The hearing transcript is available from DEQ upon request.

Name	Affiliation	Representing
Koopman, Roger	State Representative, House District 70	
Kakuk, Michael		
Oppel, Glenn	Montanan Association of Realtors	
Simkins, W.		
Pruitt, A.D.		
Oslund, Michele		
Stewart, Dustin	Montana Building Industry Assoc.	
Zell, Margot	MT Whitewater	
Gettleman, Michael		
Borer, Anne	Big Sky Chamber of Commerce	
Gammon, Ross	Montana Department of Transportation	
Hawks Bob	State Senator, Senate District 33	
Kloczko, Justin		
Schroeder, David		

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Appendices

Appendix A: Written Comments Received by DEQ during the Public Comment Period

Due to file size,
Appendix A is available as a separate download

Appendix B: Background and Rationale used to Evaluate the Hydrogeology along the Gallatin River

Technical Memorandum

November 7, 2006

To: Leanne Roulson, Garcia and Associates
Fr: Tom Osborne & Shane Bofto, HydroSolutions Inc.
Re: Rationale and Explanation for Final Aquifer Vulnerability Footprint Map, Gallatin Outstanding Resource Water Final EIS

A draft Technical Memorandum on this topic was distributed January 18, 2006 for review and comment by the GANDA Gallatin River Outstanding Resource Water (ORW) EIS project team and the Montana Department of Environmental Quality (DEQ). Comments were received January 26, 2006 from Eric Regensberger of the DEQ. A final Technical Memorandum, which was included in the Draft EIS, was issued June 14, 2006. It provided documentation of the procedures used to evaluate the Gallatin River Aquifer Vulnerability Footprint Map for the Draft EIS, and incorporates the edits and suggestions received. This revised final Technical Memorandum includes minor additions or edits in response to comments on the Draft EIS and internal review. The Footprint Map delineation was not changed from the Draft EIS.

HydroSolutions performed an aquifer vulnerability assessment and prepared a vulnerability "footprint" map in support of the Draft Gallatin River ORW EIS. The descriptor, "footprint", was utilized because, the shallow groundwater system has a direct hydraulic connection to the Gallatin River within this map outline, and because DEQ would likely apply non-degradation of water quality analysis to subdivision development within this area. In addition, other activities subject to water quality permitting and non-degradation rules could also be reviewed by DEQ.

This Technical Memo is a summary of the background and rationale used to evaluate the hydrogeology along the Gallatin River and identify areas where the shallow aquifers are in direct hydraulic communication with the Gallatin River or principal tributaries within the study area, and therefore are likely to transmit contaminants to the river. The principal goal of this study is to apply standard hydrogeologic methods and utilize existing information to produce scientifically defensible analyses and interpretations suitable for the policy and management objectives of the DEQ.

Groundwater vulnerability to contamination was defined by the National Research Council (Focazio, et al., 2000) as "the tendency or likelihood for contaminants to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer." In the context of the Gallatin River ORW assessment, the "specified position in the groundwater system" of most interest is anywhere that groundwater will likely discharge to the river; that is, where groundwater is in direct hydrologic connection with the river. We performed a type of vulnerability study which is termed an "aquifer-sensitivity" or "intrinsic-susceptibility" assessment. This is a measure of the relative ease with which water enters and moves through an

aquifer; it is a characteristic of the aquifer and overlying material and hydrologic conditions, and is independent of the chemical characteristics of the contaminant and its sources (Focazio, et al., 2000).

This study began with the review of hydrologic and geologic publications, literature, and data which specifically targeted the Gallatin River watershed, and provided examples of analogous vulnerability assessments conducted elsewhere, or were appropriate references for this work. Based on this review, the methodology developed for the vulnerability assessment is a hybrid of a "subjective rating method" and a "process-based method". Subjective methods produce categories of vulnerability (usually high, medium and low) that are targeted for use by agencies to achieve policy or management objectives. Process methods apply scientific methods or models to calculate the distribution of vulnerability based on movement of water and solutes. This method often requires further interpretation prior to use by agencies and others.

This vulnerability assessment stems from a previous study by David O. Baldwin, whose 1997 Masters degree thesis, was "Aquifer Vulnerability Assessment of the Big Sky Area, Montana". Baldwin produced this study for his Masters of Science degree in the Department of Geological Engineering at Montana Tech of the University of Montana. This study was an assessment of the intrinsic vulnerability of local aquifers at Big Sky, Montana. A Geographical Information System (GIS) was used as a platform to analyze the data and publish vulnerability maps. Baldwin's work was, in part, funded by the Montana DEQ. Baldwin authored a second report for DEQ, entitled, "Hydrogeologic and Hydrochemical Investigation of the Big Sky Area" (1996). This report is a baseline hydrogeologic and water quality evaluation of aquifers in the Big Sky area.

The Baldwin studies included only the watershed of the West Fork of the Gallatin River. However, most of the rock units and aquifers assessed in that study are also found throughout the study area for the Gallatin River ORW EIS. Subsequent to the Baldwin studies, a geologic map of the Ennis 30º x 60º Quadrangle was completed by the U.S. Geological Survey (Kellog and Williams, 2000). This assessment used the USGS rock classification system and made appropriate translations from Baldwin's rock categories where variations occurred, based on geologic age, lithology and map positions. The assignments of aquifer vulnerability classes and correlation with Baldwin's study are summarized in Table 1. Where geologic units were not specifically categorized by Baldwin, the vulnerability rating was assigned on the basis of estimated aquifer characteristics inferred from lithology, field inspection and experience.

The vulnerability criteria in the Baldwin studies (Baldwin, 1996; 1997) were:

- Aquifer characteristics
- Soil media
- Depth to groundwater, and
- Geologic units comprising the vadose zone.

Baldwin assigned vulnerability rankings to geologic units based on estimates of saturated hydraulic conductivity (K). HydroSolutions used values of hydraulic conductivity and hydraulic

gradient from Baldwin and from engineering studies conducted for subdivisions in the Big Sky area (Morrison-Maierle, 1997; 2005), along with effective porosity information from published sources to estimate groundwater velocities. Aquifers with rapid groundwater velocities result in a more direct hydraulic connection with the Gallatin River, and the zone of direct connection extends a greater distance from the river. The best estimate of the average linear velocity of groundwater in each type of aquifer was determined, and the corresponding distance of groundwater travel in one year (1-Year Time of Travel, or 1-Year TOT) was determined as indicated in Table 2. The 1-Year Time of Travel distance from the edge of the Gallatin River for each aquifer type was used as one of the setback criteria in the vulnerability footprint map. The 1-year TOT is selected as criteria because of the following:

- It is a well established basis for aquifer vulnerability assessments (Focazio, et al, 2000)
- It is already used by other DEQ programs such as Wellhead Protection
- A TOT less than one year provides little opportunity for dilution and attenuation of contaminants
- TOT may be estimated with limited hydrogeologic data, and
- TOT may be verified by hydrogeologic testing which is often already performed in the planning stages of subdivisions and other significant land developments.

The distribution of the geologic units along the Gallatin River EIS study area into aquifer vulnerability categories (high, moderate and low) based on this evaluation is provided in Table 3. Highly-vulnerable aquifers have a relative high inherent potential for contaminants to be transported to the Gallatin River, while low-vulnerability aquifers have relatively low inherent contaminant-transport potential, based on the best estimates of groundwater velocities from available information.

The vulnerability footprint map was produced by applying the criteria and classifications shown in Tables 1, 2 and 3 with other criteria from studies by Baldwin (1997) and Woessner, et al. (1996), including depth to groundwater, mapped septic system plume length, and whether the aquifer is confined or unconfined. The resulting footprint map guidelines and setback distances established for each category of aquifer vulnerability are summarized in Table 4.

The procedure for mapping the extent of the aquifer vulnerability footprint is as follows:

- The one-year TOT setback as shown in Table 4 was applied to each geologic unit that is in contact with the river, where that unit was likely to be unconfined by other low permeability rock units.

- The West Fork and its tributaries were mapped in general conformance to the criteria applied by Baldwin (1997); other tributaries were mapped from their confluence with the Gallatin River main stem to the most upstream extent of high vulnerability units in direct contact with the mapped blue line depicting that tributary.

- The setback distances in the first row of Table 4 were applied from the outermost banks of the Gallatin River or tributaries, as determined on 1:24,000 scale base maps.

- Setback distances were modified where: a) topographic contour lines indicated the land surface was 40 feet or greater above river elevation (indicating that the depth to groundwater at that point was probably 25 feet or greater), except that the minimum setback distance is 300 feet; and, b) alluvium (Qal) and terrace gravel deposits (Qg) mapped in apparent contact with alluvial deposits, were included within the footprint area even if greater than 40-feet above river level.

- A minimum setback was applied to the Madison Group everywhere, regardless of elevation, due to potential for karst conditions and known springs that discharge to the Gallatin River. This distance was not less than the shorter of, a) ½-mile, b) the ridge top of Madison Group closest to the river, or c) a change to another geologic unit.

The "40 foot elevation above river level modification" was derived from Baldwin's "high" vulnerability criteria of 25 feet or less to the water table. Using the water table gradient maps in Baldwin (1997), it was estimated that when the land surface elevation is 40 feet or greater above the river, the depth to the water table is likely to be at least 25 feet. The existing U.S. Geological Survey topographic maps use 40-foot topographic contour intervals, thus allowing for reasonably-accurate interpolations of the 40-foot elevation criteria in creating the vulnerability footprint map.

The minimum of a 300-foot setback from the river was obtained from studies of septic system plumes conducted by University of Montana hydrogeology Professor William Woessner, and his students (Woessner, et al., 1996). These studies were conducted in shallow groundwater settings near Missoula, which may not differ greatly from the Gallatin River valley. Their studies indicated that contaminants from residential septic systems could be measured in the aquifer at distances over 200 feet from the source. A Masters of Science degree report by Boer (2002), also of The University of Montana Department of Geology, evaluated sources of nitrate contamination to shallow groundwater near Lolo, Montana. He found concentrations of nitrate down-gradient of un-sewered subdivisions were commonly above 2.5 mg/l and reached 4.6 mg/l. He reported that nitrate-contaminated groundwater discharged directly to the Bitterroot River, and that this could potentially exceed the 0.010 mg/l trigger for non-degradation review.

The full extent of continuously mapped alluvium (Qal) and terrace gravel (Qg) deposits along river valleys were included in the footprint area even if greater than 40-feet above river level, since geologic data contained in available studies (Morrison Maierle, 1997, 2005), and well logs (GWIC, 2006) indicated that these deposits are typically very coarse-grained and have a direct potential connection to streams. Thus even though the alluvium and gravel terraces may be greater than 40-feet above river level, and may not be initially saturated with groundwater, discharge from on-site wastewater systems in these units would likely create a locally saturated zone or groundwater mound which would have a direct hydraulic connection to surface waters. For the purposes of the Draft EIS, including these areas prevented possible underestimation of

the extent of land area found to be in hydraulic communication with the Gallatin River or its tributaries in later site-specific evaluations.

The Madison Group aquifer is karstic, meaning it has large solution cavities and interconnected openings. Studies by Montana State University student, John Schaffer, under the direction of Earth Science Professor, Steven Custer, demonstrated that the Madison aquifer discharges about 70 cubic feet per second (cfs) of groundwater year-round to the Gallatin River near Big Sky. This discharge occurs in a series of springs which are visible both above and below the confluence with the West Fork. Snowflake Springs, just north of the Yellowstone National Park boundary, also visibly discharges a large quantity of groundwater directly to the Gallatin River. Groundwater can travel long distances in short times in karst aquifers, with little attenuation of contaminants. The setback distance was based on the shorter of the 1-Year TOT (1/2-mile), the distance to the closest ridge top from the Gallatin River, or a change to another geologic unit.

HydroSolutions applied the above methodology by computer-aided mapping in an ArcGIS environment. A GIS specialist magnified successive portions of the study area, and drew the outline of the vulnerability footprint area according to the above criteria. The outline was checked by an experienced hydrogeologist.

All contamination rating systems of this kind have limitations. Limitations of this method, include, but are not limited to the following:

- The vulnerability footprint map is based on existing information. Field studies were not conducted specifically for this evaluation.

- Hydrogeologic data from Baldwin (1997) are limited and may not represent the full range of parameters found in the geologic units along the main stem of the Gallatin River.

- Hydrogeologic characteristics vary substantially even within specific geologic units and the calculated setback distances vary with the parameters used in the calculations. The available hydrogeologic information was not sufficient to perform sensitivity analysis.

- The scales of the geologic maps and topographic maps limit the accuracy of the line used to define the vulnerability footprint area.

- It was assumed that the Gallatin River and its tributaries are a "gaining" stream system, that is, groundwater discharges to the river; in places it is possible that the river discharges to the groundwater system, although evidence of this was not found.

- Attenuation of contaminants is not specifically considered in developing the footprint map, since contaminants vary markedly with respect to attenuation mechanisms. The footprint map is consistent with advective groundwater transport of conservative contaminants.

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Table 1. Geologic Unit Classifications.

Geologic Symbol	Description of Geologic Units in Footprint	Vulnerability Class #	Baldwin's Class	Relative Groundwater Velocity
Qal	Alluvium	3	3	High
Ql	Landslide deposits	1	1	Low
Qcl	Colluvium and loess	2	NA	Moderate
Qg	Terrace-gravel deposits	3	NA	High
Qti	Till	1	1	Low
Ku	Everts Fm., Virgelle Sandstone, Telegraph Creek Fm., Cody Shale, Frontier Fm., and Mowry Shale	2	2	Moderate
Kmo	Mowry Shale	2	2	Moderate
Kmt	Muddy Sandstone and Thermopolis Shale	3	3	High
Kk	Kootenai Fm.	3	3	High
Jm	Morrison Fm.	2	2	Moderate
JTru	Morrison Fm., Ellis Group, and Woodside Siltstone and Dinwoody Fm.	2	2	Moderate
Ps	Shedhorn Sandstone	3	3	High
Pmqa	Quadrand Sandstone, Amsden Group, and Snowcrest Range Group	3	3	High
Mm	Madison Group	3	3	High
MDtj	Three Forks Fm., and Jefferson Fm.	2	2	Moderate
Cmi	Park Shale, Meagher Limestone, Wolsey Fm., and Flathead Sandstone	2	NA	Moderate
Agp	Granite porphyry of Hell Roaring Creek	1	NA	Low
Agg	Granitic orthogneiss	1	NA	Low
Aqf	Quartzofeldspathic gneiss	1	NA	Low
Aam	Hornblende-plagioclase gneiss and amphibolite	1	NA	Low
Abs	Biotite shist	1	NA	Low
Abh	Biotite-hornblende gneiss of Beartrap Canyon	1	NA	Low

Geologic unit symbols and description from Kellog and Williams (2000).
Aquifer Vulnerability Ranking: 3 – Highest, 2 – Moderate, 1 – Lowest vulnerability (Baldwin, 1997).
NA – Classification by Baldwin (1997) not available; classified based on lithology, field inspection and experience.
Relative groundwater velocity based on calculations in Table 2.

Table 2. Groundwater Velocity And One-Year Time Of Travel Distance Calculations.

High Velocity Unconsolidated Units				**Information Sources**
Hydraulic Conductivity	K	1115	ft/d	Pumping Test of Ramshorn Subdivision #T-2 Well (Morrison-Maierle, 1997)
Gradient	i	0.0125	ft/ft	Determination of Significance for Ramshorn Subdivision (MDEQ, 1998)
Effective Porosity	n	0.25		Coarse-Medium Gravel (Walton, 1996)
Average Linear Groundwater Velocity	V	55.75	ft/d	
1 Year Travel Distance		20349	ft	
High Velocity Sedimentary Units				
Hydraulic Conductivity	K	1136	ft/d	Pumping Test of Well RR#4, Rimrock Subdivision (Morrison-Maierle, 2005)
Gradient	i	0.00125	ft/ft	Rimrock Subdivision Aquifer Test Results (Morrison-Maierle, 2005)
Effective Porosity	n	0.2		Fracture storage plus matrix storage (Freeze and Cherry, 1979)
Average Linear Groundwater Velocity	V	7.10	ft/d	
1 Year Travel Distance		2592	ft	
Moderate Velocity Sedimentary Units				
Hydraulic Conductivity	K	3.16	ft/d	Geomean of K for "Moderate" conductivity units (Baldwin, 1997)
Gradient	i	0.086	ft/ft	Fractured rock gradient (Baldwin, 1997)
Effective Porosity	n	0.05		Fractured shale (Freeze and Cherry, 1979)
Average Linear Groundwater Velocity	V	5.44	ft/d	
1 Year Travel Distance		1985	ft	
Low Velocity Units				
Hydraulic Conductivity	K	1	ft/d	Average K for "Low" conductivity unit (Baldwin, 1997)
Gradient	i	0.086	ft/ft	Fractured rock gradient (Baldwin, 1997)
Effective Porosity	n	0.025		Mid-range of fractured crystalline rocks (Freeze and Cherry, 1979)
Average Linear Groundwater Velocity	V	3.44	ft/d	
1 Year Travel Distance		1256	ft	

Average Linear Groundwater Velocity (V) = (Ki)/n.

Table 3. Aquifer Vulnerability Assessment And Footprint Map Guidelines For Gallatin River Outstanding Resource Water Draft EIS.

Highly Vulnerable Unconsolidated Units (high groundwater velocity)	**Highly Vulnerable Bedrock Units** (high groundwater velocity)	**Moderately Vulnerable Geologic Units** (moderate groundwater velocity)	**Low Vulnerability Geologic Units** (low groundwater velocity)
Rank: 3 [a]	**Rank: 3**	**Rank: 2**	**Rank: 1**
Qal- Alluvium [b]	Kmt- Muddy Sandstone and Thermopolis Shale	Qcl- Colluvium and loess	Ql- Landslide deposits
Qg- Terrace-gravel deposits	Kk- Kootenai Fm.	Ku- Everts Fm., Virgelle Sandstone, Telegraph Creek Fm., Cody Shale, Frontier Fm., and Mowry Shale	Qti- Till
	Ps- Shedhorn Sandstone	Kmo- Mowry Shale	Agp- Granite porphyry of Hell Roaring Creek
	Pmqa- Quadrand Sandstone, Amsden Group, and Snowcrest Range Group	Jm- Morrison Fm.	Agg- Granitic orthogneiss
	Mm- Madison Group	Jtru- Morrison Fm., Ellis Group, and Woodside Siltstone and Dinwoody Fm.	Aqf- Quartzofeldspathic gneiss
		MDtj- Three Forks Fm., and Jefferson Fm.	Aam- Hornblende-plagioclase gneiss and amphibolite
		Cmi- Park Shale, Meagher Limestone, Wolsey Fm., and Flathead Sandstone	Abs- Biotite shist
			Abh- Biotite-hornblende gneiss of Beartrap Canyon

[a] Ranking of relative aquifer vulnerability (3 = highest vulnerability) adapted from Baldwin (1997) with interpretations for additional units based on estimated aquifer properties.

[b] Geologic unit names and abbreviations taken from 1:100000 scale geologic map (Kellog & Williams, 2000).

Table 4. Setback Criteria For Potential Contaminant Sources From Main Stem Of Gallatin River And Perennial Tributaries By Characteristics Of The Uppermost Aquifer

Highly Vulnerable Coarse-Grained Units (high groundwater velocity)	**Highly Vulnerable Geologic Units** (high groundwater velocity)	**Moderately Vulnerable Geologic Units** (moderate groundwater velocity)	**Low Vulnerability Geologic Units** (lower groundwater velocity)
Rank: 3	**Rank: 3**	**Rank: 2**	**Rank: 1**
Full extent of continuous deposit in contact with Gallatin River or tributaries (1-Year TOT is greater than 1 mile) [a].	A setback of ½-mile (2640 feet) [a] where the aquifer is unconfined, or	A setback of 2000 feet [a] where the aquifer is unconfined, or	A setback of ¼-mile (1320 feet) [a] where the aquifer is unconfined, or
	A setback from the Gallatin River or tributaries where land surface is 40 [b] feet or greater above average river elevation in the shortest linear direction.	A setback from the Gallatin River or tributaries where land surface is 40 [b] feet or greater above average river elevation in the shortest linear direction.	A setback from the Gallatin River or tributaries where land surface is 40 [b] feet or greater above average river elevation in the shortest linear direction.
	except, that the minimum setback shall not be less than 300 feet;	except, that the minimum setback shall not be less than 300 feet;	except, that the minimum setback shall not be less than 300 feet;
	except, if bedrock aquifer is shown to be confined, the minimum setback of 300 feet [c] applies.	except, if bedrock aquifer is shown to be confined, the minimum setback of 300 feet [c] applies.	except, if bedrock aquifer is shown to be confined, the minimum setback of 300 feet [c] applies.
	except, the minimum setback for Madison Group (Mm) shall not be less than the shorter of ½-mile, the Madison ridge top closest to the river, or a change in geologic unit.		

[a] Setback distance based on One-Year Time of Travel distance calculated from best available data.
[b] 40-foot elevation difference results in estimated 25-feet or more above the water table; criteria from Baldwin (1997).
[c] 300-foot setback distance interpreted from septic system plume studies by Woessner, et al. (1996).